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CONTENTS

DIESEL RAILWAY TRACTION

A Supplement illustrating and describing developments in Diesel Railway Traction is presented with each copy of this week's issue.

An Extensive One-Class Innovation on the L.M.S.R.

WE have already referred, in our issues of September 11 and 25, to the chief alterations in the winter timetable of the L.M.S.R., which came into force on Monday. A further examination of the timetable, however, shows another interesting change of which no mention has been made. This is the abolition of class distinctions on the whole system of the former Stratford-upon-Avon & Midland Junction Railway, comprising the 45½ miles between Broom Junction and Blisworth and the 16½-mile branch from Towcester to Banbury. Actually there are still two classes between Banbury and Farthinghoe, as this section is used also by the Banbury to Verney Junction trains, but, in any event, this short length of line was not owned by the S. & M.J.R. in pre-grouping days and so does not invalidate our remark. With the exception of passing loops, the whole of the former S. & M.J.R. lines are single track, and the traffic has always been sparse, needing the most rigid economy to enable operations to be continued at all. The S. & M.J.R. does, however, assist in providing the shortest journey in point of distance between London and Stratford-upon-Avon, the 93 miles miles from Marylebone via Woodford comparing with 101 miles from Euston via Blisworth, and 102¾ miles on the G.W.R. throughout from Paddington. The introduction of one-class traffic over about 60 route miles (the whole system of a pre-grouping railway) is probably the most extensive experiment of its kind yet made, and is therefore of considerable interest.

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The Silver Jubilee's Birthday

In the past the claim has been made not infrequently that the congestion of British main lines would make it impossible to find a path for ultra-high-speed train services. To any such claim the successful working of the L.N.E.R. Silver Jubilee service during the first year of its history, which came to an end during the past week, provides a sufficient answer. Not only has a path been found for a 70·4 m.p.h. booking in both directions over the 232·3-mile main line between King's Cross and Darlington, which for most of its length is as busily occupied as any in the country, but on 278 of its 498 journeys the flyer has arrived from 1 to 5 min. before time. It is also a matter for remark that the one set of coaches, with no opportunity for complete overhaul other than that given by the few days adjacent to the public holidays, when the Silver Jubilee does not run, has travelled 133,464 miles in the one year on this high speed schedule, 115,536 of them at an average speed of over 70 m.p.h., at least 30,000 at over 80 m.p.h., daily reaching 90 m.p.h. maxima, and occasionally travelling at up to the 100 m.p.h. level, with a culmination in the 113 m.p.h. of August 27 last. Best of all, the train has proved both the desire of the public for high speed and its willingness to pay extra for speed by running filled to capacity on almost every trip. It is small wonder, in the circumstances, that the L.N.E.R. authorities, as mentioned on page 539 of this issue are exploring by test runs the possibility of similar services in other directions.

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The Week's Traffics

A notable feature in the traffics for the past week is that the L.M.S.R. total increase for the year to date has now touched 4 per cent. Each of the four main line companies has increased its total percentage increase to date in comparison with that shown at the end of the previous week, but this has been caused entirely by passenger train earnings. In this class of traffic the L.M.S.R. percentage increase has risen from 1·84 to 1·98; the L.N.E.R. from 1·65 to 1·81; and the Southern from 1·33 to 1·39. Merchandise percentage increases to date have, on the other hand, fallen:—On the L.M.S.R. from 5·92 to 5·88; on the L.N.E.R. from 4·02 to 3·98; and on the Great Western from 4·33 to 4·32. Total traffics of the four companies to date now amount to £117,405,000, an increase of £3,699,000, or 3·25 per cent.

	39th Week				Year to date	
	Pass., &c.	Goods, &c.	Coal, &c.	Total	Inc. or Dec.	
	£	£	£	£	£	%
L.M.S.R. ..	+ 37,000	+ 21,000	− 5,000	+ 53,000	+ 1,829,000	+ 4·003
L.N.E.R. ..	+ 25,000	+ 9,000	—	+ 34,000	+ 1,137,000	+ 3·43
G.W.R. ..	+ 8,000	+ 8,000	− 3,000	+ 13,000	+ 476,000	+ 2·49
S.R.	+ 12,000	+ 3,500	− 2,500	+ 13,000	+ 257,000	+ 1·64

London Transport receipts for the past week total £575,600, an increase of £19,000, and the aggregate for the 13 weeks of the financial year is £7,234,900, an increase of £222,100.

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Railways and Holiday Resort Publicity

At the annual meeting of the North Wales Holiday Resorts Association, held at Rhyl last week, the Chairman, Mr. Pugh Parry, said that since it was formed twenty-seven years ago the association had raised over £17,000 for publicity purposes, and of that amount £11,000 had been spent on press advertising, with splendid results. Mr. E. Cheadle, of the L.M.S.R. Publicity Department, said the

company had spent over £2,500 in advertising North Wales in the national press and had recently tried a novel way of discovering which method of advertising really was the best. All the passengers in several excursion trains had been asked how they had learned of the excursions, and 70 per cent. replied that they had seen the advertisements in the newspapers. A somewhat different form of publicity was launched last week, but with the same objective as that referred to at the North Wales meeting, and also providing an example of the joint publicity of a holiday resort and the railway serving it. This was the presentation of two cinema films that have been produced by the Southport Publicity and Attractions Committee in co-operation with the L.M.S.R. One film shows Southport as a winter resort and the other, in colour, was taken in August. These pictures are to be circulated through the railway company's film library for exhibition to members of clubs, societies, and so forth.

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Tunisian Railways in 1935

The unhappy task of the Tunisian Railways in administering a mixed gauge system 1,000 route miles in extent, built mainly for strategic and cultural purposes, was eased slightly during 1935 by an appreciable increase in the goods tonnage carried, which resulted in an increase of 2 per cent. in the total receipts. The operating expenditure was reduced by 9·5 per cent., and receipts of fr. 47,405,993 against the expenditure of fr. 98,114,178 gave an operating ratio of 208, compared with 236 in 1934. Despite an increase of 3 per cent. in the number of passengers carried, the passenger receipts dropped by 5 per cent. as a result of a lower tariff introduced during the year in an endeavour to regain traffic from the road. Goods traffic increased by 20·5 per cent. to 1,562,255 tonnes, but the goods revenue rose only by 5 per cent. The most striking feature was the increase of 116 per cent. in the cereal traffic to a total of 209,760 tonnes, due to a lowering of rates, but the annual report says that a further increase is unlikely in 1936. However, an increase in passenger traffic has been experienced on the standard-gauge lines in the north, following the acquisition of six 70-seater railcars at the beginning of 1936. No new works were carried out during 1935, but Westinghouse air brakes were fitted to 16 locomotives and 66 carriages and wagons (all standard gauge) in place of vacuum brake equipment. Additional to the revenue and expenditure mentioned above, the accounts include the figures of the associated road company, the Tunisienne Automobile Transports, which show receipts totalling fr. 10,995,125 against an expenditure of fr. 10,989,017.

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The Mount Washington Cog Railway

The first idea of carrying tourists up a mountain by rail appears to have been conceived by Mr. S. Marsh in the U.S.A. when, in 1857, he proposed to build a rack railway to convey passengers to the top of Mount Washington, the highest of the White Mountains, in New Hampshire. Though treated at first as the dream of a madman, the scheme was eventually carried out between 1867 and 1869. Where necessary to provide an even road-bed, timber trestles were largely used, and this form of construction has survived to the present time; actually 3 miles out of the total length of 3¾ miles are on trestle. The railway is worked only during the summer, from about June 20 to October 18, and the service is " weather permitting " at the extremities of the season. We have recently received a current pamphlet advertising the facilities which gives justifiable prominence to the record of the company in having operated for 67 years without an accident to a passenger. The summit is more than a mile (6,293 ft.) above sea level, and the average gradient of the line is 25 per cent., with a maximum of 37·41 per cent. on " Jacob's Ladder." Steam locomotives push the 40-seat carriages on the up journey and precede them on the descent. Among many enterprising devices to encourage traffic is the working a " sunset special," which begins the ascent at 5.30 p.m. during July and August and caters for an inclusive trip comprising the journey (normally $3 return) and dinner, lodging, and breakfast at the Summit House for $8 to $10, or transport, supper, lodging, and breakfast at the Tip Top House for $6 to $8.

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A New L.M.S.R. " Coronation " Engine

In honour of the coronation next May of King Edward VIII, the L.M.S.R. has announced its intention of naming one of its " Princess Royal " class express locomotives *Coronation*. The company is thus following the precedent established in 1911, when one of the former London & North Western Railway express engines then building at Crewe works—it was the 5,000th locomotive to be built there—was so named in honour of the coronation of King George V and Queen Mary. This was a 4-4-0 of the " George the Fifth " class, built to the designs of Mr. C. J. Bowen Cooke, Chief Mechanical Engineer of the L.N.W.R. and originally numbered 5000. The class was notable as being the first on the L.N.W.R. to use superheating, and 24 sets of superheater tubes contributed 302 sq. ft. to the total heating surface of 1,850 sq. ft. That engine is still in service, stationed at Chester, and bearing the L.M.S.R. No. 25348, but is to be withdrawn shortly owing to this type of locomotive having become obsolete, and the way will thus be clear for the name to be allotted to the new engine without depriving the veteran of 1911 of the proud title it has borne for a quarter of a century. It will be recalled that the *Coronation* took part last year in the jubilee exhibition of L.M.S.R. locomotives and rolling stock held at Euston in connection with the twenty-fifth anniversary of King George V's reign. Whereas the new L.M.S.R. *Coronation* engine will weigh over 160 tons, the weight of its older namesake is less than 100 tons, and the latter is capable of drawing not much more than half the load of the new engine at an equivalent speed. The two *Coronation* locomotives will in fact typify a quarter-of-a-century's progress in locomotive design on the L.M.S.R.

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The Hiawatha

Already one of the fastest long-distance trains in the world, the Hiawatha of the Chicago, Milwaukee, St. Paul and Pacific RR. has become a considerably more difficult proposition of haulage this summer by the addition, between Chicago and New Lisbon, of a section serving the North Woods area of North Wisconsin. When first introduced in May, 1935, the Hiawatha was a six-car train, and the use of light alloys and welding reduced the weight of the stock from what would have been a total of nearly 500 tons, with vehicles of ordinary American design, to about 300 tons all told. Over the 280·8 miles between Chicago and La Crosse the time allowed was 4 hr. 11 min. each way, needing an overall average of 67·1 m.p.h. inclusive of three intermediate stops; west of La Crosse, to St. Paul and Minneapolis, slower running was necessitated by track conditions. This year, despite the addition of the North Woods section, attached to the train throughout the 221·0 miles from Chicago to New Lisbon, the westbound running time remains unchanged. But in the eastbound direction, the attaching of the North Woods vehicles at New Lisbon has made necessary a curtailment in running time of 10 min. from there to Chicago, the 221·0 miles being run in 3 hr. 10 min., at 69·8 m.p.h.,

including stops at Portage and Milwaukee. The 43·1 miles from New Lisbon to Portage are run in 34 min., at 76·1 m.p.h. start-to-stop; and the Milwaukee-Chicago time has been reduced from 75 to 70 min. for the 85·0 miles, which, in view of the restricted speeds necessary in the suburban areas of these two cities, must demand a running average of at least 90 m.p.h. intermediately.

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Quarter Day and Household Removals

In connection with quarter day, which fell on Tuesday last, the British railways made extensive arrangements to handle the thousands of household removals that result from the termination of tenancies at this period. Naturally, specially-fitted removal containers played a prominent part in these activities, and it is interesting to record that in March last (according to statistics compiled by the "Universal Directory of Railway Officials and Railway Year Book") the railways had over 800 suitable containers available. The L.M.S.R. headed the list with 300 K type furniture containers (of 3 tons capacity) and 100 KX type (of 4 tons capacity). Next came the L.N.E.R. with 200 BK 4-ton type, and the G.W.R. followed with 113 K 4-ton type. The Southern Railway stock of containers included 97 K type of 4 tons capacity. The railways claim, and not without justification, that all the inconvenience formerly associated with "moving-day" has been dispelled, for they will, at an inclusive charge, carry out all the incidentals relating to the removal, lay the linoleum and carpets, and even make arrangements to dig over the garden. Notable for its size was a recent job handled by the L.M.S.R. in connection with an important industrial development, when 350 households were removed as one transaction from the Lanarkshire area to Corby (Northants). Speed and safety, which are all-important considerations of a modern removal service, were exemplified recently when a family moved from London to North Wales. Members of the family saw their furniture leave in an L.M.S.R. container one afternoon, and early next morning they were safely installed with their furniture positioned in their new home, 195 miles away.

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Mr. Stanier's Presidential Address

It would, we think, be difficult to choose a subject more likely to interest a gathering of locomotive engineers than that adopted by Mr. W. A. Stanier for his presidential address on Wednesday last to the Institution of Locomotive Engineers, namely, "The Development of Locomotive Design during Recent Years." The historical aspect of the subject provides an interest of its own, seemingly of the kind never likely to diminish; one, moreover, that has the distinction of always being added to as one generation succeeds another. What is for the time being topical must, however, make a more direct appeal to the practitioner who is compelled to live for the most part in the present, however absorbing he may find an occasional dive into the past as a recreation, or as an aid to the refreshment of his memory. In his address Mr. Stanier covered many of the principal aspects of modern locomotive practice, treating his subject from the standpoint of one who is responsible for the locomotive policy of one of the greatest railways in the world in relation to the design and construction of large numbers of engines varying in size and capacity. He was voicing the opinion of the majority when he predicted a long and useful life for the steam locomotive in face of all growing competition from other forms of tractor adaptable for railway purposes. He had informative things to say about turbine locomotives, streamlining, and other developments belonging to the most recent practice, and included equally useful dissertations on such standard features as the boiler, valve gears, feedwater treatment, and some metallurgical aspects of his subject. He concluded with a reference to the desirability of establishing a more certain method of testing locomotives, while there was still much to be done and a wide margin to attack. The heat value of the fuel and the efficiency of the locomotive as expressed by the work done still left something to be accomplished. An abstract of the address will be found on pages 536-7 of this issue.

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Weed Killing on German State Railway

Before the war even the main lines of certain Continental railways were covered with vegetation in the summer months, but the increasing care bestowed on the permanent way in recent years has changed all that, and even branch lines on the Continent are now usually as clean as anything we have in this country. This is due partly to the greatly improved ballasting and drainage on most of the main lines, but the use of weed killing chemicals has contributed much. In Germany, for instance, for some years past, obsolete locomotive tenders have been used as tanks for weed killing solution which has been distributed to the track by gravity, after the manner of the old-fashioned watering cart. Since 1934, however, pumps have been used to spray the liquid weed killer under pressure through very fine nozzles, a proceeding which is found to be both more effective and cheaper. The chemical used is sodium chlorate and it is found that about 45 kg. is required to kill weeds over 1 km. of slightly overgrown track. Although sodium chlorate is not poisonous externally, it is deadly if taken internally. Further, in contact with certain materials such as coal and oil, and when dry on clothing, it is highly inflammable. The German State Railway employees therefore who work in connection with the weed killing trains wear special clothes when on duty which are thoroughly washed immediately they are removed, and all other necessary precautions are taken to reduce the risk of accident. (*See illustration on page* 530.)

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Intercepting Defective Rails

Questions have often been asked as to why the Sperry method of detecting internal flaws in the steel, which has proved so effective as applied to rails in the track, cannot equally be applied at the rolling mill where the rails are made, so that the defective rails might thus be intercepted at the source. The reply is that the transverse fissure, the detection of which, in view of its dangerous possibilities of sudden rail breakage, was the primary object of Dr. Elmer Sperry in perfecting his apparatus, is normally so minute a nucleus immediately after manufacture as to be incapable of electrical detection; and it is only after being subjected to the stresses set up by the passage of trains over it that the fissure grows to detectable size. Apart from transverse fissures, the presence of piping and other internal defects which are also responsible for fissuring—though usually in the longitudinal and not the transverse plane of the rail—is so relatively infrequent that the cost of instituting plant for the detection of these alone at the rolling mill would hardly be justified; moreover such defects usually give external warning of their presence before failure of the rail, whereas the internal fissure does not. But in the case of partly worn rails reconditioned at the ends for re-use in secondary tracks, fissure detection at the reconditioning depot is valuable, and an article on page 531 of this issue shows how Sperry equipment is in use in America for this purpose, and has lately been brought into use in France also.

The London-Paris Train Ferry Service

THE middle of this month will witness an epoch-making event in the history of British and Continental international transport, when for the first time a passenger will be able to retire to his berth in a sleeping car in London and get up from it again in Paris with no change of vehicle or disturbance between these capitals. The installation of the Dover—Dunkerque train ferry service will make this possible and also an accelerated service of perishable goods to and from the Continent, without break of bulk. When the question of the establishment of a train ferry service between an English Channel port and France was considered, every possible location for the terminal on this side was, we understand, studied. The conditions at the various points that came under review were such as to indicate beyond doubt that Dover would provide the most suitable port on the English side. All likely sites were closely examined and the form of construction of the terminal also was considered from every aspect. Usually at ferry terminals where there is variation in the water level due to tidal action, a hinged bridge of suitable length can be arranged to connect the ship with the shore, this bridge forming an inclined approach as the sea level varies with the state of the tide. At Dover the extreme variation between the highest and lowest water level is 25 ft., and this would have necessitated that the length of such an inclined approach over which sleeping car trains could pass would have been about 500 ft. Further, the weather conditions in Dover Harbour are at times very severe, and on numerous occasions the heavy swell which prevails would have prevented the mooring of the ship to such a bridge. It was also desirable to provide facilities enabling the ferry traffic to be dealt with in the shortest possible time when transferring the trains between the ship and the shore, and also for ensuring that punctual and regular services could be dealt with day or night, with due regard also to the possibility of considerable expansion of these services in the future.

Finally it was decided that the most suitable design would be an enclosed dock—the entrance to which could be opened or closed at will—in which to berth the ferry vessels. Powerful pumps could then regulate the water level inside the dock so as to raise or lower the vessel to the requisite level in the shortest possible time. The dock gates would also protect the vessel and bridge gear from heavy seas in stormy weather. The site selected for the dock was as close as possible to the present Marine station, as from a traffic working point of view this position is the most convenient. Accordingly, Parliamentary powers were duly sought and obtained and the work was let to contract. A brief description of the engineering work involved, and of the great difficulties encountered in the construction of this dock will be found on page 525. While these complex civil engineering works were in hand the Southern Railway placed orders for three train ferry steamers with Swan, Hunter, & Wigham Richardson Limited of Newcastle-on-Tyne, and these vessels were duly named *Twickenham Ferry*, *Hampton Ferry*, and *Shepperton Ferry* and delivered. Their principal dimensions are length 359 ft., beam 63 ft. 9 in., and mean laden draught 12 ft. 6 in.; they are designed for a speed of 16½ knots. The train deck of each contains four railway tracks collectively capable of holding 12 coaches or 40 wagons. In the regular sleeping car service the two centre tracks will be used for the passenger coaches and the outer tracks will be used for freight wagons. The after part of the train deck will also be available for holding large motor vehicles which cannot conveniently travel in the garage on the upper deck. Normally cars will be housed in transit in this upper-deck large garage, into which they will be driven by way of an inclined approach from the quay level. Ordinary passenger accommodation—dining saloons, smoking rooms, private cabins, and so forth—is also provided on the upper decks, and first and second class passengers will be carried in the usual way as well as sleeping car passengers. When the sleeping car service is inaugurated on October14, passengers will leave Victoria at 10.0 p.m. and arrive in Paris at the Gare du Nord at 8.55 the following morning. They need not leave their berths *en route*, but if they prefer to do so, they may, of course, visit the restaurant and refreshment bars on the upper deck of the ferry vessel, to which there is convenient access from the train deck. There will also be a daily service for freight providing an additional and more direct service between the Continent and London in through wagon loads.

To obviate the expense of constructing British coaching stock that could be used only on this one special service, new sleeping cars were specially designed by the Compagnie Internationale des Wagons-Lits for use on the train ferry route. In order to conform to the comparatively small English loading gauge dimensions the coaches, which are of all-steel construction, measure 62 ft. 11 in. in overall length and 9 ft. 0¼ in. in width, the height from rail level being 12 ft. 9½ in. The ends of the carriage underframes and the bogie frames are constructed of cast steel, thus securing a decided economy in weight. The springing is of normal type, and the walls of the carriages are insulated with sheets of ground and compressed cork, so as to reduce noise to a minimum. A special feature of the interior arrangement of the sleeping cars is that each compartment is designed for use either for one first class or two second class passengers. The goods stock required for this through ferry service has been built to the order of the principal French railways and the Southern Railway. It is designed to suit the loading gauges of both English and French systems and is distinguished by the addition of the letter "S" to each wagon or van number. Altogether, some 1,400 vehicles have been allocated to this service and others are to be provided when required. In addition to this ordinary stock, 100 refrigerator vans, constructed to suit the British loading limits, will also be available. This very direct route with its short sea passage should prove very popular especially for fruit, vegetables and other perishables. By obviating the necessity for double handling, for expensive packing and for break of bulk from city to city, and by saving much time, the new service will enable traders to effect considerable savings in their *grande vitesse* transport costs.

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The International Railway Congress Association

THE International Railway Congress Association has completed fifty years of valuable work in connection with the development of railways throughout the world, and, as recorded in our issue of April 17, has issued a commemorative brochure. In 1885 the Belgian Government, as part of the celebrations of the fiftieth year of the operation of the Belgian railways, convened at Brussels a scientific railway congress, the purpose of which was to enable representatives of Governments and railway companies throughout the world to discuss problems connected with the construction and organisation of railways. So successful was the congress, for which 229 delegates accepted the invitation to attend, that during the proceedings it was decided to appoint a special commission to prepare for a further congress and to draw up regulations for the formation of a scientific

association which could assist the technical progress of railways by means of discussions, circulation of technical data, and the interchange of views of the member administrations. This led directly to the formation of the International Railway Congress Association, as the Belgian and French authorities actively supported the proposal, and a permanent commission was set up which met for the first time on February 20, 1886. Regulations for an international association were prepared by this body and approved at the next congress, held in Milan in 1887. Since that date the association has organised ten further congresses which have been held in various important cities throughout the world, including London, Washington, Paris, Madrid, Petersburg, and Cairo; the number of delegates attending these meetings has in some cases exceeded nine hundred.

From its earliest days the association has followed the practice of dividing the work of the congress into sections, in order that the delegates might study those particular problems in which they were interested. The sections are Way & Works; Locomotives and Rolling Stock; Working; General; and Light Railways respectively. The desirability of limiting the subjects for discussion was also realised at an early date, and arrangements were made for certain delegates to prepare reports on the various subjects for discussion. Later, special reporters were appointed for the purpose of collating and condensing the gathered material into a concise report for the purpose of facilitating the discussion. The success and usefulness of the congress meetings are attributable largely to the very careful preparatory work which is carried out. The member-administrations make suggestions as to the most useful subjects for discussion at the next congress and, when these have been settled, the members are asked to suggest the most suitable representatives of the various railways for appointment as reporters. These then proceed, through the agency of the association, to collate the necessary data affecting their particular subject from the member administrations throughout the world and, after they have been assimilated and summarised, the results published in the *Bulletin* of the association, together with a report of the actual discussion at the congress.

That the collation, dissemination, and discussion of this authoritative information have been of great assistance to the railway industry may be judged from the fact that while, at its formation, its members operated 31,000 miles of railway, its membership today comprises over 200 railways operating 318,000 miles of track, as well as forty governments. Although the congresses are nominally held every five years, the intervals vary, as the dates are frequently altered to coincide with national events. Thus it was decided in 1933 that the next congress should be held in Paris in 1938, but it has since been agreed to hold it in May-June, 1937, in order that it may coincide with the Paris Exhibition.

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Lübeck-Büchen Railway Results

THIS railway has shared in the improved economic conditions in Germany, and the report for 1935 shows an increase of 8·3 per cent. in passengers carried, with 7·7 per cent. more receipts, and 20·3 per cent. more goods conveyed, with an increase in receipts of 15·7 per cent., mostly from the lower scales of rates. Cheap fare facilities were extended during the year, and the free carriage of goods intended for winter relief work was continued. A profit on working of 53,700 RM. was made after all charges were met, which is regarded as very satisfactory in view of the large sums that have been found in recent years, without outside aid, to make up the arrears of renewals and maintenance left from the crisis years. Last year 1,240,000 RM. were found out of receipts for this purpose and 1,640,000 RM. drawn from the reserve fund. A total sum of 14,000,000 RM., it is anticipated, will be spent in this way. A considerable amount of permanent way has been renewed and reballasted, old rails have been replaced by those of Reichsbahn standards, and many new points installed. The Hamburg-Lübeck section has been equipped with three-aspect distant signals, and lock-and-block has replaced block telegraph between Lübeck and Travemunde, where extensive signalling renewals have been undertaken. Moreover, two new superheated 2-4-2 tank locomotives for express services, two 2-10-0 goods locomotives, a steam tractor for the works, and a diesel tractor for shunting have been acquired. Further improvements have also been made in the train timings. The number of staff employed rose from 2,483 to 2,560, but wage rates remained unaltered.

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A Railway for Auction

IT is not often in this country that a railway—even a private line carrying no passenger traffic—is put up for auction, but such an event is scheduled for October 14, and, moreover, the railway in question is one of considerable interest. The auction, which has been advertised to be held at Blossom's Hotel, Chester, is of the Park and Croesor estates in the county of Merioneth, North Wales, which are of industrial importance chiefly for their slate and granite quarries and copper mine. Lot 1, forming the north-easterly portion of the area, comprises the Croesor estate totalling 1,358 acres, the upper portion (534 acres) of the Park estate, the Croesor Railway, and an inclined railway known as the Pant Mawr Incline. The Croesor Railway, about 7 miles in length, was built from the upper end of the Croesor valley to Portmadoc in three sections, and the first two sections are part of the Croesor Estate property and as such are included in the auction.

Work on the Croesor Railway was undertaken privately about three-quarters of a century ago by Mr. Hugh Beaver Roberts, then a prominent landowner in North Wales, in order to provide rail access with the waterside at Portmadoc for the Croesor valley. A gauge of 2 ft. (or more precisely 1 ft. 11½ in.) was adopted, as this was the gauge used on the neighbouring Festiniog Railway. About 1864, with the impending approach of the Cambrian Railways into these parts, it was deemed advisable to convert into a public railway the lower section of the Croesor line. Application to Parliament resulted in the incorporation by Act of July 5, 1865, of the Croesor & Portmadoc Railway Company, with powers to convert into a public railway the section of the existing line from Carrig Hylldrem to Portmadoc. This company changed its name to the Portmadoc, Croesor, & Beddgelert Tram-Railway Company in 1879. Three years later a receiver was appointed as payments on a mortgage of 1870 were overdue, and the receivership continued until 1901 when the property was sold to a new company called the Portmadoc, Beddgelert, and South Snowdon Railway. It may be added that passenger traffic had never been begun, but the new owners participated in a plan which eventually came to fruition after the war as the Welsh Highland Light Railway when the ancient line was linked with the North Wales Narrow Gauge Railways to provide a through line from Portmadoc to Dinas (near Carnarvon).

The remaining two sections that now constitute the Croesor Railway include three double-track gravity inclines, namely, Blaencwm 835 ft. long, Upper Park 1,225

ft. long, and Lower Park 1,725 ft. long, all with complete equipment of drums, wire ropes, control brakes, and so forth. The necessary shunting sidings are provided at the top and bottom of every incline, at Tresaethon, Brynhyfryd, and at the upper terminus of the railway. In addition to the Croesor Railway proper the Rhosydd Slate Co. Ltd. built a railway and incline from the Rhosydd quarry to the terminus of the Croesor line under a deed of mutual covenants dated October 1, 1863, made between the company and Mr. H. B. Roberts, whereby the latter granted the necessary wayleave. The original wayleave was 2d. a ton but was afterwards reduced to 1d. a ton, and although the deed expired on March 25, 1906, similar arrangements continued until about 1921 when the wayleave was increased to 2d. Although the whole railway is included in Lot 1 at the forthcoming auction, the lower section, from the village of Croesor to Carrig Hylldrem, traverses the property comprising Lot 2, and this part is being offered for sale subject to the conditions of a deed of June 20, 1871 (which related *inter alia* to the carriage of goods on the railway), but it is stated that no person has exercised or claimed any such rights for upwards of 20 years.

* * * *

The Railways of Syria

SYRIA is a geographical term for part of the former Turkish territories in Asia Minor often called the Levant States. Since the British forces drove the Turks out of these parts in 1918 there have been both territorial and governmental changes, but the whole area now under French control may be considered conveniently as Syria, although it comprises various autonomous states under French mandate. These are Syria proper (the amalgamated states of Damascus and Aleppo), Grand Lebanon, Latakia, and Jebel Druze. At the present time all the railways in the area are worked by the Société Française du Chemin de fer Damas-Hama et Prolongements. The company's own system comprises the Aleppo-Rayak main line of 207½ miles, and its 63½ mile branch from Homs to Tripoli, both of standard gauge; and some 93 miles of 105 cm. (3 ft. 5¼ in.) gauge line between Beirut and Damascus, via Rayak, of which about 32 km. (roughly 20 miles) are equipped with rack rail on the Abt system. In addition, the company works the 153 miles of the Hedjaz Railway (3 ft. 5¼ in. gauge) on Syrian soil; about 125 miles of the former Baghdad Railway (4 ft. 8½ in. gauge); and the narrow-gauge Tramways Libanais from Beirut to Mameltein. The whole D.H.P. system thus totals about 650 miles.

France has had intimate commercial relations with Syria for many centuries, and a French company formed in 1865 was given a Turkish concession to transport passengers and goods by road between Damascus and Beirut. The enterprise prospered and was of considerable commercial importance, so it was natural that French interests should take up the question of railway communication. The Société des Chemins de fer ottomans économiques de Beyrouth-Damas-Hauran was established in Paris is 1891, and on June 13 of that year secured a Turkish Government Firman to build a 105 cm. (3 ft. 5¼ in.) gauge railway from Beirut to Damascus and on to Mezerib in the Hauran region. This line was opened on August 3 (July 22 old calendar), 1895, but five years later its value was seriously impaired by the decision of Abdul Hamid to build the Pilgrim or Hedjaz Railway from Damascus to Mecca, the northern part of which would parallel the Damascus-Mezerib section of the French railway. The Damascus-Amman portion of the Hedjaz was opened on August 23, 1904, and at first relied for its outlet to the sea on the Beirut-Damascus section of the French company. The Hedjaz administration, however, became dissatisfied with this position and sought its own access to the Mediterranean by means of a branch from Deraa to the port of Haifa; this was completed in 1906.

In the north of Syria, the Beyrouth-Damas-Hauran Railway obtained in June, 1893, from the Turkish Government both permission to build a standard-gauge railway from Damascus to Homs, Hama, Aleppo, and Birijik (on the Euphrates), with a branch to the coast, and also the promise of guaranteed receipts. Before this was built the Government sanctioned the Baghdad Railway, a part of which route north-east of Aleppo clashed with that of the French company. The matter was eventually adjusted, and the French undertaking, which changed its name to the Société ottomane du Chemin de fer Damas-Hama et Prolongements, built a standard gauge railway from Rayak (on the Beirut-Damascus line) only as far as Aleppo, which was reached in 1906. Transshipment facilities were provided at Rayak, and in 1914 a junction with the Baghdad Railway was effected at Aleppo. The intended standard-gauge branch to the coast was built from Homs to Tripoli and opened in June, 1911.

After the war the D.H.P. Railway resumed possession of its line, but with the Damascus-Mezerib (3 ft. 5¼ in. gauge), and the Tripoli-Homs (standard gauge) sections taken up. The former was not worth relaying, as the Hedjaz Railway paralleled it, and the D.H.P. Railway took over as from March 1, 1924, the administration of the Syrian section of the Hedjaz system, namely, Damascus to El Hamme and Deraa to Nessib, totalling 205 km. of 3 ft. 5¼ in. gauge. Steps were taken in 1920 to restore the Tripoli-Homs line and it was reopened on October 1, 1921, giving standard-gauge rail access to the coast entirely on Syrian soil. The Baghdad Railway was seriously affected by the establishment of the Syro-Turkish frontier, for its line was divided at various points by the boundary. Eventually the French and Turkish authorities agreed that the section from Yenice to Nisibin, and its branches, should be worked by a French company, and this arrangement came into force in 1922. The company was at first known as the Chemins de fer de Cilicie-Nord Syrie, but afterwards became the Société d'exploitation des Chemins de fer de Bozanti-Alep-Nissibine et Prolongements, and was commonly called the B.A.N.P. It maintained its portion of the Taurus Express route until July 1, 1933, when the present scheme became effective, whereby all the lines on Syrian soil are worked by the D.H.P. Railway. This concern took over the operation of sections of the Baghdad Railway totalling about 125 miles, and the portions inside the Turkish frontier passed in part to that Government and the remainder to the newly-formed South Turkish Railway.

THE CHESHAM BRANCH LINE.—Last week a report gained currency that the London Passenger Transport Board had decided to electrify the single-track 4-mile branch line between Chalfont and Chesham. Actually this branch is part of the Met & G.C. Joint system, and the agreement of both partners (the L.P.T.B. and the L.N.E.R.) would be necessary before any such decision were arrived at. We are officially informed that the reports concerning the proposed electrification of the Chesham branch are premature, and that the question of any change in the method of operating that line is at present under consideration by the L.N.E.R. and London Transport. It will be recalled that in July last the L.P.T.B. ordered two 260 b.h.p. diesel-engined A.E.C. streamlined railcars similar to those used on the G.W.R., and then announced that they were for service on the Chesham branch.

PUBLICATIONS RECEIVED

Guide to the Pavilion of His Majesty's Government in the United Kingdom, at the Empire Exhibition, Johannesburg, South Africa, 1936. Published by the Department of Overseas Trade. 8½ in. × 5½ in. 89 pp.—This ingeniously-bound guide is so arranged that if it is taken up and read from one end the United Kingdom Pavilion is described in English, whereas if it is turned over it reads in Afrikaans from the other end. The briefest of introductions explains that the U.K. Government welcomes the exhibition as an opportunity to contribute to an Empire-wide demonstration of the progress and unity of the British Commonwealth of Nations. Also that the U.K. exhibits are designed to show the increasingly important part played by transport and communications by land, sea and air in welding together the peoples of the Empire. A plan and description of the pavilion follow, and then the royal dais is depicted, with its bronze bust of the King, flanked by figures of gentlemen-at-arms, retired officers of the Navy and Army, and Lifeguards. The central feature of the Rotunda is a great relief map of the world, with miniature models of endless successions of British ships plying its oceans, passing through actual water. Illuminated glass tubes indicate Empire air routes. To illustrate the development of transport and communications, there are four panoramas ; one contains the scale models of a progressing series of locomotives from the *Rocket* to the *Silver Link*, and another corresponding models of motorcars. Of the other two, one demonstrates progress by sea with models from the coracle to the *Queen Mary*, and the other similar air progress. Many of these models are described and illustrated in the guide serially according to date. In the Afrikaans it is interesting to see the Adams L.S.W.R. 4-4-0 model described as "Adams Ekspres-Passasierslokomotief," and a G.W.R. railcar as "Die G.R.W. Stroombelynde Swaaroliespoorwegkar."

Abroad in Ireland. By John Gibbons. London : Frederick Muller Limited, 29, Great James Street, W.C.1. 7½ in. × 5 in. 291 pp. Price 7s. 6d. net.—Once again Mr. Gibbons takes us into a foreign country, and makes us see, hear, feel, and smell it. For Ireland is a foreign country to an Englishman of the post-war generation ; indeed, the Ireland of to-day is a foreign country to all Englishmen. The author naturally has a great deal to say about the Gaelic renaissance, and also about the former semi-Anglicised Ireland which he knew as a boy. Many of us knew the Ireland of "pre-trouble" days, but too few know the new Ireland, with its new industries, its slum clearances, its co-ordinated rail and road transport, and its Great Southern Railways that have not been afraid to substitute modern road services for uneconomical train services on branch lines. From a passenger's point of view, the general standard of rail and road maintenance in Ireland is now little inferior to that of Great Britain, in spite of the fact that Ireland possesses but a fraction of Britain's traffic. "Abroad in Ireland" may turn out to be an eye-opener to many who do not know Ireland, or at any rate the modern republican Ireland. Mr. Gibbons is a Roman Catholic, as any reader of his books will soon find out. At the same time, he is an Englishman. Therefore he is a man likely to approach the country and its people with sympathy, yet without any blindly enthusiastic partisanship. In his book you feel that you are really learning something about the Irish people of today. It tells of a country, a most serious and uncomic country, that fights against a strong tide of prejudice and stagnant tradition. It tells of a people among whom men and women of all social and professional classes may be seen climbing barefoot through the rocks and heather to the summit of a sacred mountain, or fasting on tea and black bread for three days and nights while they do penance on a sacred island. Some may say that this sort of asceticism is all wrong, and savours as much of Druidism as of Catholicism. But it is impressive, for all that ; as impressive as the manner in which a dying language has been forcibly revived to the point of becoming the official language of the country. Talking of language, Mr. Gibbons's English is sometimes rather funny, but not for worlds would we have him change it.

Field Engineering : A Handbook of the Theory and Practice of Railway Surveying, Location and Construction. By Wm. H. Searles. 21st edition, revised and enlarged by Howard Chapin Ives. London : Chapman & Hall, 11, Henrietta Street, W.C.2 ; New York : John Wiley & Sons, Inc. 7 in. × 4¼ in. × ⅞ in. 403 pp. Price 20s. net.—The twenty-first edition of Searles' *Field Engineering* consists of two volumes bound as one, the first being the text and the second tables. Originally published in New York in 1880 this handbook of the theory and practice of railway surveying, location and construction, has performed continuous service to the engineer. In the preface to the first edition, which is reprinted in the present edition, the aim of the work was set forth in six points : first, to present the general subject of railway field work in a progressive and logical order for the benefit of beginners ; secondly, to classify the various problems presented so that they might be readily referred to ; thirdly, to embrace discussions of all the more important practical questions while avoiding matters non-essential ; fourthly, to employ throughout the work a uniform and systematic notation easily understood and remembered ; fifthly, to express the resulting formula of every problem in the shape best adapted to convenient numerical computation ; and, sixthly, to furnish a large variety of useful tables easily adapted to the wants of the field engineer. Changes to bring subsequent editions up-to-date have been generous, as, for example, when the text of the seventeenth edition was entirely reset. In the present edition two principal changes to the text have been made. Chapter XIX, "String Lining Curves," has been contributed by Prof. Philip Kissam of Princeton University ; and Chapter XX, "Highway Curves," has been entirely rewritten. Tables L, LI and LII are additions to the tabular section in connection with the chapter on "Highway Curves." The material for Tables XXIIA and XXIIB, giving data regarding railway turnouts up to crossings with an angle of 1 in 20, are new and have been furnished by the American Railway Engineering Association.

Electro-Plating and Metal Finishing.—B. J. Round & Sons, of 8-10, Northampton Street, Birmingham, has issued a new edition of "The Electro-Plating and Metal Finishing Industry and the Epalex System," a handy booklet giving particulars of the deposition of metals and methods of finishing by the firm's own process. Reference is also made to the Pylumin chemical process of protecting aluminium, which forms a cohesive bond for paint, lacquers and enamel finishes.

Pit Tubs and Railway Wagons.—Details of the constructional principles which have earned for Butterley pit tubs and railway wagons their reputation for strength are illustrated in a catalogue which we have received from the makers, The Butterley Co. Ltd., Codnor Park, Ironville, Nottingham. The latest addition to the range of railway wagons is an all-welded vehicle; other types, with bolted assembly, are also illustrated. The special features of construction facilitate dismantling for repairs, and the drainage system is specially designed to prevent corrosion when the wagons are used for washed coal. Steel containers built up of standardised interchangeable parts, and all-steel lorry bodies, are other items in the catalogue.

Self-balancing Windows.—An illustrated leaflet from Beckett, Laycock & Watkinson Limited, Acton Lane, London, N.W.10, shows a controlled half-drop window suitable for road vehicles or light railcars. It is free from rattle, being positively locked in any position, but requires very little pressure to operate it. The special window channel and runner are designed for silent and easy working. Passengers will appreciate the neat and sturdy operating handle, the finger catch of which is particularly comfortable to work. Other leaflets show self-balancing windows for marine use, which have a special grease-lubricating system for the compression springs, arranged for gun lubrication through nipples arranged at any accessible point.

THE SCRAP HEAP

"Railway engines are generally regarded as feminine." But not mail vans.—*From "The Star."*

Golfers are interested in a new wooden-headed driver that has just been introduced to them. We could introduce them to quite a few more.

". . . . a kind of heavier sunlight not unlike that of a big railway station on a very fine day, which has quite an attraction of its own."—*From "They Walk in the City" by J. B. Priestley.*

We are indebted to one of our readers for sending us the interesting German waybill reproduced below. As will be seen, this was issued as recently as September 2 of the present year, and was used in connection with the through registration of one package of luggage from Kiel to London via the Flushing—Harwich service. In view of the years which have elapsed since the formation of the Deutsche Reichsbahn, it is very unusual to find still in use a form of one of the pre-war German railway administrations (in this case the Preussisch-Hessische Staatseisenbahnen) especially in connection with international traffic. Our correspondent points out that the Munster—Wesel—Goch—Boxtel route has now ceased to be of international importance in so far as traffic from this country is concerned, and the English port of the Flushing service was transferred from Folkestone to Harwich in January, 1927, while the Queenboro' route has been abandoned even longer. In spite of the routing shown, the luggage in question must have travelled by the present day route via the German—Dutch frontier stations of Bentheim and Oldenzaal, and was promptly received at Liverpool Street.

It is noteworthy that of all the railways constructed up to the opening of the Liverpool & Manchester Railway, not one was undertaken with a view to the conveyance of passengers. In the prospectus published by the projectors of the Liverpool & Manchester Line, it was, indeed, held out as probable one-half of the number of persons then travelling by coaches between the two towns might avail themselves of the railway in consideration of the lower rate for which they would be conveyed, and the directors expected to realise an income of £20,000 per annum from that source; but the chief inducement held out to subscribers was the conveyance of raw cotton, manufactured goods, coal, and cattle.

COMPETITION

The sea serpent must be held responsible. "This year's model does 100 m.p.h.," says a headline in one of the best-known of our Northern newspapers, in describing the reactions of startled holidaymakers on seeing the latest apparition off the Yorkshire coast. It was, of course, quite clear that our progressive railways could not be permitted to lag behind in the competition with this notable marine acceleration, so another paragraph in the same journal comments, *au grand sérieux*, on rumours that have been overheard by its London correspondent regarding the future of the Silver Jubilee express of the L.N.E.R. These rumours were to the effect that presently this famous train might have its London-Newcastle schedule cut to three hours. "To accomplish the journey from Newcastle to London in three hours is a comparatively simple proposition, so far as the capacity of the locomotives is concerned," we read with as much astonishment as the holidaymakers who witnessed the sea serpent doing his measured mile. "But," the writer adds, "it would mean an average for the journey of some 90 miles an hour, and to secure this would involve so much rearrangement of the existing services as to make it quite unremunerative." So, we learn with regret, the rumours that the London-Newcastle time is to be reduced to three hours "may be dismissed"; and for the time being "this year's model" of sea serpent is to have it all his own way, but as yet we have seen no announcement that he intends to carry passengers.

№ 32

Preußisch-Hessische Staatseisenbahnen

Chemins de fer prussien-hessois de l'Etat. - Ferrovie prussiano-hess. dello Stato. - Prussian-Hessian State Railways.

Gepäckempfangsschein - Récépissé. - Scontrino-bagagli. - Receipt.

von (de — da — from) Kiel Hof nach (à — a — to) London Liverpool St.

über (via) Hamburg-Bremen-Osnabrück- Münster-Wesel-Goch-Boxtel / Salzbergen-Zütphen-Oss -Vlissingen- Folkestone / Queenboro

Datum (Date / Data)	Zahl der Fahrkarten (Nombre des billets / Quantità dei biglietti / Number of tickets)	Zahl der Gepäckstücke (Nombre des colis / Quantità dei colli / Number of packages)	Wirkliches Gewicht (Poids réel / Peso effettivo / Actual weight) kg	Gepäckfracht - Taxes - Tasse - Rates	ℳ	Pf.
2/9 19 36				Deutsche Strecken — Zone / Parcours allemand — Zone / Percorso germanico — Zona / German lines — Zone: 30	3	60
				Ausserdeutsche Strecken (Parcours non-allemands / Percorsi non germanici / Non German lines) — ohne Freigepäck für (sans franchise de bagages pour / senza franchigia di bagagli per / without free luggage for) 30 kg	3	10
Zug (Train / Treno) 1	1	1	25	mit Freigepäck für (avec franchise de bagages pour / con franchigia di bagaglio per / with free luggage for) ... kg	—	
№ 38				ℳ Interesse an der Lieferung — Intérêt à la livraison / Interesse alla riconsegna — Interest in the delivery		65
				Nebengebühren — Frais accessoires — spese accessorie — sundry charges		
				Erhebungsbetrag — Taxe perçue — Somma riscossa — Amount received	7	15

Pre-war German waybill used last month for international traffic

No. 12 of a series of "claims prevention" posters recently issued by the Chief Goods Manager, Great Western Railway, for exhibition to the staff

THE RETORT COURTEOUS

Shareholders' meetings in the past furnished many examples of wit. The following formed part of the proceedings of a Great Western Railway meeting held in 1861:—

Mr. Adams, a proprietor, with reference to another proprietor's speech (recommending somewhat belligerent measures towards a rival company) remarked that clergymen were usually of a combative turn, whereupon the revd. proprietor replied that Mr. Adams looked like a greengrocer. Mr. Adams retorted hotly that he was no greengrocer, but he thought that in making such a remark the revd. proprietor was the grocer (grosser). The sharpness of the retort, and the fact that the clergyman was most uncomfortably fat, convulsed the meeting in laughter.

OVERSEAS RAILWAY AFFAIRS

(From our special correspondents)

INDIA

Railway Act Amendment

The Legislative Assembly negatived the Railway Member's motion to refer his Bill—which seeks to amend the Indian Railway Act so as to provide adequate check to illicit travel—to a select committee, and the Bill is therefore to be circulated to elicit public opinion. This urgent measure of reform is, thus, further postponed.

Kollengode-Trichur Railway Project

At the function connected with the laying of the foundation stone of the Cochin Harbour monument by H.H. the Maharaja of Cochin, Mr. R. C. Bristow, Harbour Engineer-in-Chief to the Madras Government and Chief Administrative Officer of the Cochin Port, pleaded for a parallel development of the connected railway and road systems along with the development of the harbour. He particularly mentioned the Kollengode-Trichur Railway scheme, the construction of which was not only a needful part of the hinterland improvement, but was essential for the complete success of the harbour. The line was only 40 miles long, and Mr. Bristow thought that with goodwill and a little give-and-take among those concerned, its construction should not be delayed indefinitely.

Puja Bazaar Special

The Puja Bazaar special, which is an annual feature of the Eastern Bengal Railway, will be on tour between September 6 and October 11, visiting 30 important broad and metric gauge stations. Traders and manufacturers have found this train particularly valuable in the maintenance of contact with up-country buyers. The space available in the train has been fully booked. The railway cinema car will accompany the special and give free open air shows at every station visited.

Railway Depreciation and Overcapitalisation

The capital at charge to the State-owned railway systems in India has risen from Rs. 643 crores in 1924-25 to Rs. 797 crores in 1935-36 and a further increase of about Rs. 3¼ crores is expected at the close of the current year. The interest charges have similarly increased during this period from Rs. 23·90 crores to Rs. 31·37 crores. This heavy burden on railway revenues has attracted considerable public attention in recent years, and the question of making adequate annual provision for the amortisation of railway capital has been raised. Mr. P. R. Rau, Financial Commissioner of Railways, has recently reviewed the Railway Appropriation Accounts for 1934-35, and his memorandum on the subject deals at length with the question of revising the present rules of allocation between capital and revenue, the adequacy of the present depreciation charges and the provision for amortisation of railway capital.

Financial Commissioner Recommends Return to Former Depreciation Policy

Mr. Rau observes that sound and prudent financial principles call for an alteration of rules so as to avoid the debit to capital of charges which do not increase the earning capacity of the railways. This is the practice followed by the Indian railways before the introduction of present Depreciation Fund Rules in 1924, and by the company-managed railways even now. These rules superseded the former practice of replacing an asset by a like asset wholly out of revenue, and initiated the present provision for depreciation on a cost basis whereby the replacement of the older assets, against which no provision had been made for arrears of depreciation, involved considerable inflation of capital. Sir Arthur Dickinson had also observed in 1926 that additional expenditure not accompanied by additional capacity or additional net earning power should not be debited to capital.

In recommending a reversion to the old and conservative practice, Mr. Rau proposes the abolition of the present distinction between wasting and non-wasting assets, so that both types of asset may come within the scope of the depreciation rules. The Financial Commissioner, further, gives his unqualified support to Sir Arthur Dickinson's view that the cost of excess capacity due to improvements in service, but not producing any greater revenue, should be charged to a special "Betterments" account to be maintained from the net income. Mr. Rau also suggests that as soon as railway revenues improve sufficiently, a lump sum provision of $\frac{1}{6}$ per cent. of capital should be annually made from revenue for "Betterment" works.

Dangerously Low Reserve

Regarding the adequacy of the contribution to the Depreciation Fund, Mr. Rau is strongly opposed to any reduction in the present scale of appropriations to the fund. He considers that the existing reserve, amounting, nominally, to Rs. 42 crores at the end of 1935-36 or 5 per cent. of the total railway capital, is much too low for an old and growing concern. It stands at this figure mainly because of the present rules of allocation, which provide for charging to capital more and to revenue or to the depreciation fund less than what ordinarily would be considered proper according to canons of sound finance.

In 1935-36, the Public Accounts Committee was particularly insistent that some provision should be made for the amortisation of railway capital. In the opinion of the Financial Commissioner, the railways cannot be considered as making a profit unless, after meeting working expenses, including full provision for renewals or depreciation, and all interest charges, they have a surplus more than sufficient to set aside a sum of about Rs. 5 crores either as contribution to the general revenues, or as a minimum provision for amortisation of capital. This amount accumulated at 3 per cent. interest would suffice to repay the capital in 58 years.

The proposed provision for betterments and amortisation involves an additional debit to revenue of Rs. 6·33 crores. Mr. Rau suggests that the provision should be made only when the revenues improve sufficiently.

VICTORIA

Special Colours for Notable Trains

In continuation of the recently-instituted policy of painting important trains in distinctive colours, Mr. Clapp, the Chairman of the Railways Commissioners, recently announced that the Adelaide express was to be painted in bright stripes. These will probably run horizontally and continuously throughout the train, giving a ribbon or streamlining effect, and it is thought likely that a new shade of bright green will be introduced. The other two specially coloured trains are the blue boat train and the yellow Better Farming train. It is considered almost certain that the new semi-streamlined, all-steel, air-conditioned Sydney express will also appear in a characteristic colour scheme, as these gay liveries undoubtedly have an important publicity value.

RHODESIA

Main Line Relaying

The Rhodesia Railways main line between Salisbury and Hunter's Road is now being relaid with 80 lb. B.S.S. flat-bottomed rails. The total quantity of materials required is 160 track miles, and the weight of them is about 23,000 tons. Since early in May they have been arriving at Beira at the average rate of about 1,000 tons a week, and sent up to Salisbury whence they are distributed by two trains at about the same average rate. As the new rails are 40 ft. long and the earlier ones had never exceeded 33 ft., there were only 37-ft. trucks available on this system. The South African Railways have, however, lent Rhodesia some 45-ft. trucks in exchange for high-sided bogies.

Actual relaying began at two points early in July. For the 80-lb. rails, only 2,112 sleepers are considered necessary in a mile, whereas 2,240 had to be used with the old 60-lb. material.

Consequently entire sleeper respacing is necessary, and an additional 400 cu. yd. of ballast is, moreover, being put into each mile of track. The wider rail foot also entails the reboring and plugging of all sleepers.

FRANCE

Speeding up Goods and Parcels

Great progress has recently been made by the French railways in speeding up goods traffic as an essential factor of successful competition with road transport. Fast goods transit has become more than ever necessary in France, where the business depression has forced traders to reduce their stocks to a minimum, while the increased variety of goods offered for sale and the insistence of customers on the prompt execution of orders make rapid replenishment of stocks an urgent need in the retail trade. Road transport with its quick door-to-door delivery has largely benefited by the facilities it can offer to traders in all parts of the country, but the railways are now doing much to recapture lost traffic. Towards the end of 1931 they introduced a special express parcels tariff, and speeded up transport by organising services of fast goods trains. These services have grown in favour with the public and have given rise to the railway advertising slogan that "parcels go like letters in the post." In October, 1935, the whole system of parcels tariffs and delivery was greatly simplified, and the parcels traffic has since expanded rapidly.

Express Consignments up to 1,100 lb.

One drawback to the simplified system was the limitation of the maximum weight to 50 kg. (110 lb.). Frequently it was found that orders for urgent consignments comprised such weighty objects as spare parts of machines and motors exceeding a hundredweight. To overcome that difficulty the railways have now introduced a special tariff for express consignments transported at the same speed and under the same conditions as express parcels. These express consignments enable goods weighing up to 500 kg. (1,100 lb.) to be despatched and delivered promptly to the entire satisfaction of traders.

It is even claimed, says the *Chronique des Transports*, that express parcels and express consignments may be delivered quicker than letters by the post. For instance, an express parcel or express consignment handed in at the Quai d'Orsay, Paris, shortly before noon is at the disposal of the consignee at Bordeaux, 360 miles away, the same evening at 8 o'clock. The express charges are described as moderate. An express parcel from Paris to Bordeaux costs Fr. 15, or slightly less than 4s., for 5 kg. (11 lb.), and an express consignment of 100 kg. (220 lb.) costs Fr. 154, or about £2.

SPAIN

British Interests in the Country

The "workers" have taken over the lines of the Great Southern of Spain Company between Baza and Lorca and Aguilas, as well as the company's private pier at Hornillo Bay on the Mediterranean coast. To the west the officer commanding the forces at Algeciras has militarised the railway between Algeciras and Bobadilla. This line originally belonged to an English company, by whom it was later sold to the Andaluces Comany, a system which was taken over by the Spanish Government just before the outbreak of the civil war. The steam ferry service between Algeciras and Gibraltar, which originally also belonged to the English company aforesaid, is now working normally.

The railway worked by the Bilbao River & Cantabrian Railway Company, whose directors have been authorised to take advantage of any opportunity to close the business in Spain, [as reported in these columns of our issue of September 18.—ED. *R.G.*] is 22 km. (13½ miles) in length, and runs from Galdames to the company's own loading wharf at Portugalete on the Bilbao River. The railway did not carry any passenger service, the traffic being limited to iron ore, and the prosperity enjoyed by the company until a few years ago made it an exception to the general run of transport undertakings in Spain.

"Workers'" Control

The "Council of Economy" recently constituted in Barcelona is now busy centralising the operations of several "workers' committees," and has assumed control of all public utility services under the new economic system, which amounts practically to a complete socialisation of industry. The anarchist-syndicalist unions are now working together in harmony with the socialists, and a formal pact of collaboration has been agreed to between these hitherto warring factions. The two groups between them nominate eight out of the fifteen members of the Council of Economy, and they are therefore in a position to control the voting. Perhaps this will put an end to the frequent squabbles, in which a railway wagon or a lorry had its roughly painted initials changed from "U.G.T." to "F.A.I." or "C.N.T.," or vice versa.

Most of the railwaymen in Catalonia, as in the rest of Spain, belonged to the established Sindicato Nacional Ferroviario, or to the more modern Federacion Nacional de la Industria Ferroviaria. The sindicato was and is a branch of the socialistic U.G.T. (General Union of Workers) whose secretary was until recently the present prime Minister of Spain, Don Francisco Largo Caballero.

The Andaluces system was an exception to the general rule, as most of the Andaluces employees belonged to the "C.N.T." (National Confederation of Labour). Hence the importance from the point of view of railway control, of the agreement between the unions.

The Tribunal of the People tried and sentenced to death on September 8, on a charge of espionage, a railway booking clerk employed on the Sastago section. The sentence was carried out and the man shot, on the following day.

Madrid Metro as Air-raid Shelter

A serious problem has arisen out of the use of the Madrid Metro (underground) Railway, for shelter during air raids. The subways are used in this way by the crowds of workers and their families in the more congested districts and not only is the movement of traffic interrupted during an air raid, but the greatest difficulty is being experienced in getting the frightened people to abandon the shelters and return to their homes after the raid is over.

ABYSSINIA

Railway Agreement

An operating agreement between Italy and the Chemin de Fer de Djibouti à Addis-Abéba has been signed, according to a despatch from Rome. In view of increased traffic due to the Italian occupation of Abyssinia, freight rates are to be reduced and cheap fares instituted for soldiers and officials. Former high freight rates which were justified by the small volume of traffic, are now to be lowered by from 20 to 30 per cent., and heavy consignments up to five tons will benefit by reductions of from 40 to 60 per cent.

As a large increase in passenger traffic is also anticipated, fares for soldiers and officials will be reduced by 50 per cent. and for troops in a body by 60 per cent. Soldiers engaged in assuring the safety of traffic are to be transported free of charge. The agreement specifies that the transport charges are payable in lire and the French railway company undertakes to buy rolling stock from Italian manufacturers thus finding a ready means of using the lire received.

BELGIUM

New Locomotives

At a board meeting of the Belgian National Railways on September 11, it was decided to order 20 new locomotives for fast passenger trains. These engines will be of the same design (Type I) as the 15 engines placed in service in 1935, which have given great satisfaction. Only a few minor alterations are to be embodied in the new series. [The original engines, which were described and illustrated in our issue of April 5, 1935, were built by John Cockerill & Cie.—ED. *R.G.*]

HIGH SPEED JUNCTIONS—I

By W. M. BOND

Modifications in alignments, and the use of two-level chairs, now being introduced on the London Midland & Scottish Railway in permanent way connections, permit of greatly increased speed and steadier running through junctions

THE question of speed is always in the foreground of permanent way design. The demands of the operating department for increased speeds on plain road can be complied with by a suitable standard of maintenance, but notwithstanding all the efforts made by the civil engineer, there are still the two main factors of curvature and junctions which frequently prevent uninterrupted high speed running.

In the case of curvature, much has been done in recent years to permit higher average speeds around curves by the Hallade method of versine control, and adopting a cant which is, at all times, proportionate to the versine. On the London Midland & Scottish Railway over 850 curves have been dealt with in this manner, giving a total of 935 single track miles, thereby making an important contribution towards this demand for higher and unrestricted speeds. However efficacious such work may be, it is negatived to some degree if permanent speed restrictions of a low order continue to be imposed at junctions, and it is with the desire to relieve or remove these restrictions that the canted connection has been developed and brought into everyday use.

The existing standards of permanent way switch and crossing design do not permit of junctions being designed so as to give both roads an unrestricted run. Even in the best of circumstances, that is, where a wide six-foot space and an unlimited length of lead are possible, the throw of the switch in one or both directions remained as an unbalanced force, and it becomes necessary to adopt some means of minimising this thrust and endeavouring to balance out the remainder. These difficulties came under three headings:—

(1) The easement of the thrust at the switch planing.
(2) Provision for cant between the heel of the planing and the obtuse crossing of the diamond.
(3) The reduction of thrust at the obtuse crossings to an absolute minimum.

Dealing with (1), and accepting the present type of switch, that is, a planed rail fitting up against a stock rail, there arise the questions of length of planing, and of curved or straight planing. The most acute standard planing on the L.M.S.R. is 1 in 80, involving a departure of $2\frac{3}{4}$ in. in 18 ft. 4 in. If a longer planing were adopted, trouble would be experienced from the general whippiness of the switch and the inability to maintain a good fit up against the stock rail, especially in closing the switch "up the cant" on turnouts from the straight where such turnout is preceded by cant in favour of the curve. The 1 in 80 planing is standard only with the longest type of switch, that is the F switch. Other switches much more frequently used are the E, D, and C, and the angles of planing for these switches are 1

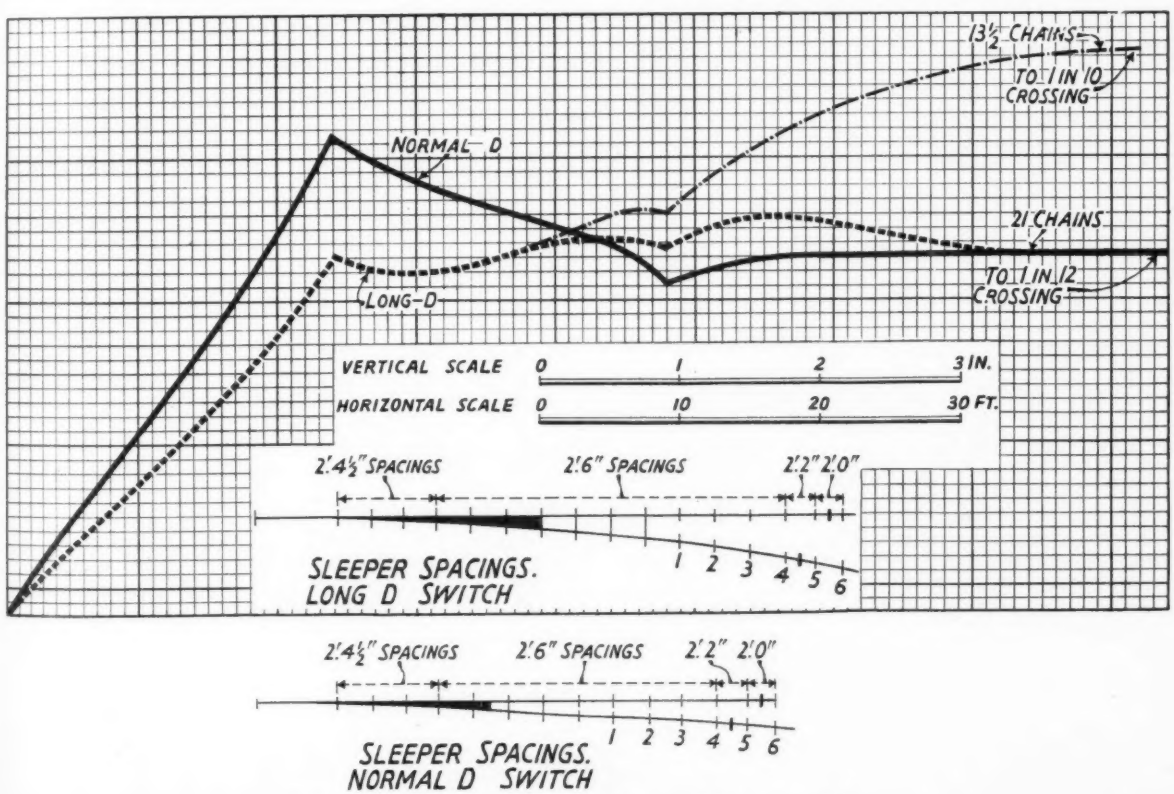
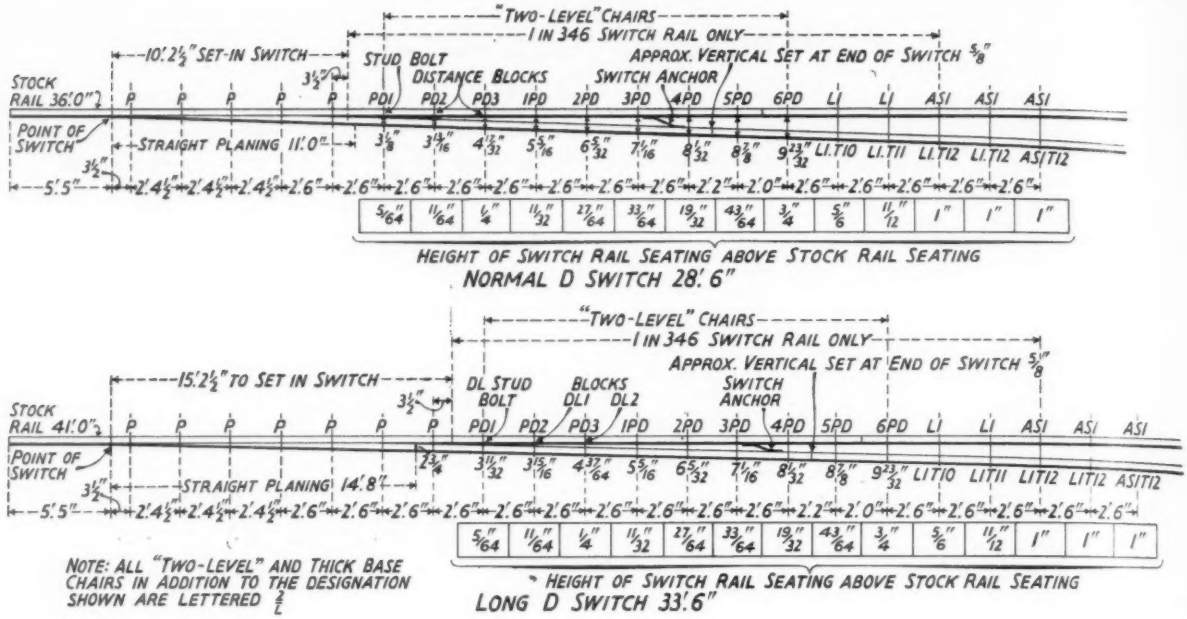


Fig. 1—Thrust curves of normal D and long D switches



in 64, 1 in 48 and 1 in 40 respectively. Perhaps the most frequently used of all these switches is the D, which, with its angle of divergence of 1 in 48, is a serious obstacle in the design of high speed junctions.

It is not intended here to enter into a discussion on the merits of curved and straight planing, but it is fairly obvious that in so short a length of planing as 11 ft. (1 in 48) the very slight curvature possible can have little advantage to the running and has the disadvantage of increasing the difficulties of maintaining a perfect fit against the stock rail. The L.M.S.R. standard is straight planing, as with the majority of other companies, and it was decided to retain this type of switch for use in canted connections.

A simple turnout may, from a running point of view, be divided into three parts. First the angle of divergence of the planing, secondly the radius of the residue of the switch, that is the portion fitted into the P or heel chairs having in consequence a fixed divergence (known as the switch curve), and thirdly, the turnout curve, that is the length on common road chairs between the last heel chair and the crossing. Consider a D switch with its natural crossing of 1 in 12, the natural crossing being the one which gives a turnout radius the same as the switch curve radius. The lead of such a turnout is approximately 97 ft., the angle of planing, as stated previously, 1 in 48, and the switch curve and turnout curve of 20·9 (say 21) ch. radius. For a proper appreciation of the characteristics of this turnout, the thrust accruing therefrom must be considered, and perhaps the best method of indicating this is by versines on a suitable chord. On the diagram opposite (Fig. 1) a chord of 48 ft. 4 in. has been chosen, as this is approximately the length between bogie centres of a coach, and is also the Hallade chord for 30 m.p.h. It can be assumed, therefore, that the versines on this chord will give the precise measurement of the thrust felt by a passenger seated in the centre of a coach travelling at 30 m.p.h. The thrusts at all other speeds are proportionate.

The heavy black line on the diagram indicates the thrust of a normal D switch with a 21-ch. turnout curve; it will be seen that the thrust at the toe rises to 3·35 in., and that at approximately half way it is reduced to 2·3 in., rising again to a continuous offset of 2·5 in. The inherent fault of this switch and turnout is therefore apparent, inasmuch as the versines instead of rising gradually into

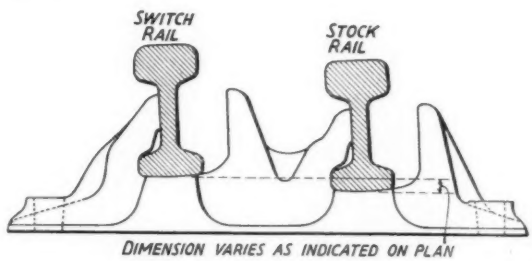


Fig. 2—Two-level chairs for D switches

their maximum thrust, which should be that of the turnout curve, rise to the maximum at the toe and recede as they approach the turnout curve. This excess of thrust at the toe of the switch must be reduced to a minimum if good running is ever to be attained. The difficulty could not be solved by merely fitting a longer type of switch than is customarily used for a given crossing and turnout curve, as all the standard switches have the same fault, that is the thrust at the toe is out of proportion to that of the switch curve, and furthermore, the mere substitution of a long switch in a given lead results in unnecessarily sharpening up the turnout radius beyond that required for the normal switch. Additionally, the inclusion of a long switch is frequently impossible where the lead length is restricted.

The problem, therefore, resolved itself into the necessity of combining the merits of various switches, and the idea was conceived of fitting a switch with E planing (1 in 64) into D heel chairs with a switch curve radius of 21 ch., and thus obtaining the desired easement in the take-off together with the reasonably rapid departure of 21 ch. The versine or thrust diagram of this combination is shown by the dotted line in Fig. 1, where the thrust at the toe rises to only 2·5 in. and remains reasonably constant throughout the remainder of the curvature. The improvement which this new switch (called the long D) gives over the old switch (the normal (D) is very evident on comparison of their two versine thrust lines.

Certain difficulties presenting themselves in this combination had next to be overcome. As will be seen in

the diagram Fig. 2, the joint of the stock rail in the normal D switch comes between the 5 and 6 P (heel) chairs, and that of the switch between the 4 and 5 heel chairs. This location of the joints in respect of the chairs had to be maintained, as the rail separation of these chairs is calculated on the special joint spacing of 2 ft. and 2 ft. 2 in. respectively. This was overcome by making the switch 5 ft. longer than the standard D, introducing two more slide chairs at 2 ft. 6 in. spacing and thereby permitting the length of planing to be increased from 11 ft. (1 in 48) to 14 ft. 8 in. (1 in 64).

The only remaining difficulty was with the three stud and block chairs between the last slide chair and the first heel chair. In the normal D switch, as with all other standard switches, the switch curve is tangential to the heel of the planing, and it became necessary to ease the commencement of this curve into the flatter angle of planing. For this purpose stud bolts and blocks were designed giving the correct separation as will be seen in the diagram.

Thus came into being the first working basis for getting rid of excessive throw on entering a specified turnout radius, resulting in a switch of F length (33 ft. 6 in.) with E planing (1 in 64) fitted into D chairs (21 ch. radius). A real mongrel undoubtedly, but also a real step forward in making for faster and better running.

The tangential departure of the switch curve from the heel of the planing referred to above, is in the author's opinion, another fault in the standard switch design. Consider for a moment the passage of a train over such a switch, departing from the straight. The train passes through an angle of divergence which is out of all proportion to the residue of the switch departure, and long before the effect of this has been absorbed by the locomotive it has to negotiate a pure tangent, and worse still a tangent which springs from the back of this planing angle. It is to be sincerely hoped that in future development and improvements, more attention will be paid to switch design and that at least P or heel chairs will depart transitionally from the angle of planing.

Reverting to this long D switch, and considering it fitted with a 1 in 10 crossing where the turnout radius will be 13½ ch., the versine thrust on a 48-ft. 4-in. chord for such a radius is approximately 4 in. The thrust diagram, where it differs from the long D switch with a 1 in 12 crossing, is indicated by the dot-and-dash line in Fig. 1, and it will be seen that this line gives an excellent transition with the thrust increasing steadily the whole way and the toe of the switch not unduly out of proportion with the general outline. The 1 in 10 crossing is the normal crossing to the C switch having an angle of planing of 1 in 40, and this thrust diagram clearly indicates that where such crossing and radius are to be used, the amalgamation of these with the long D switch will give the almost ideal turnout, accepting the present limitation of heel chairs and type of switch.

The E/F Switch

So far only the D and the long D switches have been dealt with, but still greater improvement is effected by a combination of the E and F switches. This combination is officially known on the L.M.S.R. as the E/F switch and consists of an F length switch (33 ft. 6 in.) with F planing (1 in 80) fitted into E chairs which have a radius of 37 ch. Such a switch, if used with a 1 in 14 crossing with a turnout radius of approximately 27 ch., would give the following progression in divergence from a straight stock rail:—

Planing 1 in 80

Radius through stud and block chairs ..	58 ch.
Radius through heel chairs	37 ch.
Radius through turnout curve	27 ch.

It is obvious from these figures that the approach to this 27-ch. curve is almost ideal and perhaps this combination represents the greatest advance made up to date in amalgamation of the several existing standards.

The long D switch becomes the best entry into a 1 in 10 crossing with a turnout radius of up to about 15 ch. The same switch is also a really efficient lead into a 1 in 12 crossing with a turnout radius of up to about 25 ch. In the same manner the new E/F switch becomes the best for a 1 in 14 crossing, with a turnout curve of from 25 to 30 ch. radius, and is a really good practical switch for a 16 crossing with a turnout curve of up to 40 ch. radius. The ideal switch for a 16 or 20 crossing and the consequent turnout curves of 40 and 60 ch. respectively yet remains to be designed. From the foregoing it can be assumed that such a switch will be fitted into F chairs (58 ch. radius) and have an angle of planing of about 1 in 95 or 1 in 100. Such a switch will undoubtedly come in the future.

In the foregoing figures of radii, the worst case has been assumed, that is a turnout from a straight road, but in instances where the lead is bisected, these curvatures are of course halved, as is also the angle of divergence of the straight planing; thus the problem of thrust is proportionately easier.

There is no real reason why the speed of trains over a junction should not be unlimited providing such cant could be applied to both roads as would balance out within the specified limits the thrusts due to speed and curvature; and the basic Hallade theory wherein it is accepted that thrusts or versines must not change at a greater rate than the cant can be changed, governs to a large extent the design of the ideal junction.

Application of Cant

So far we have considered the development of the thrust due to the curvature of the turnout. As the switches had now been designed so that the thrust was attained in a transitional sense, the application of cant at a similar rate became the next objective. It is an astonishing fact that in the whole of permanent way design, rail level throughout is at one height above sleeper level, and the principle has apparently been accepted that no cant can be given within the lead except general cant or adzing and packing. For example, at the heel of the switch there is always the necessity for cant to either one or both roads, and yet these heel chairs have always had the two seatings of the stock and switch rails at one level. It is apparent that there is a necessity for the switch rail seatings to be progressively raised chair by chair from the heel of the planing to the last heel chair.

Cant in a turnout is usually obtained by adzing the timbers for the common chairs. This method has several disadvantages; first, adzing can begin only after the initial throw of the switch and the early part of the turnout curve has been passed; secondly, the depth to which such adzing can be taken is limited by the depreciation of the timber section; and thirdly, the cutting away of the most valuable creosoted face of the timber. Lastly, adzing is extremely difficult to do with sufficient accuracy.

The first objection, that is the inability to begin the cant early enough, has always been the most serious as it is obviously necessary to start the cant as near as possible to the point where the thrust originates. The earliest point at which it is possible to start raising the switch is at the heel of the planing where the full section of the switch is developed and the full bearing for the wheel provided. As has been pointed out previously, the standard heel chair has two rail seatings, carrying the

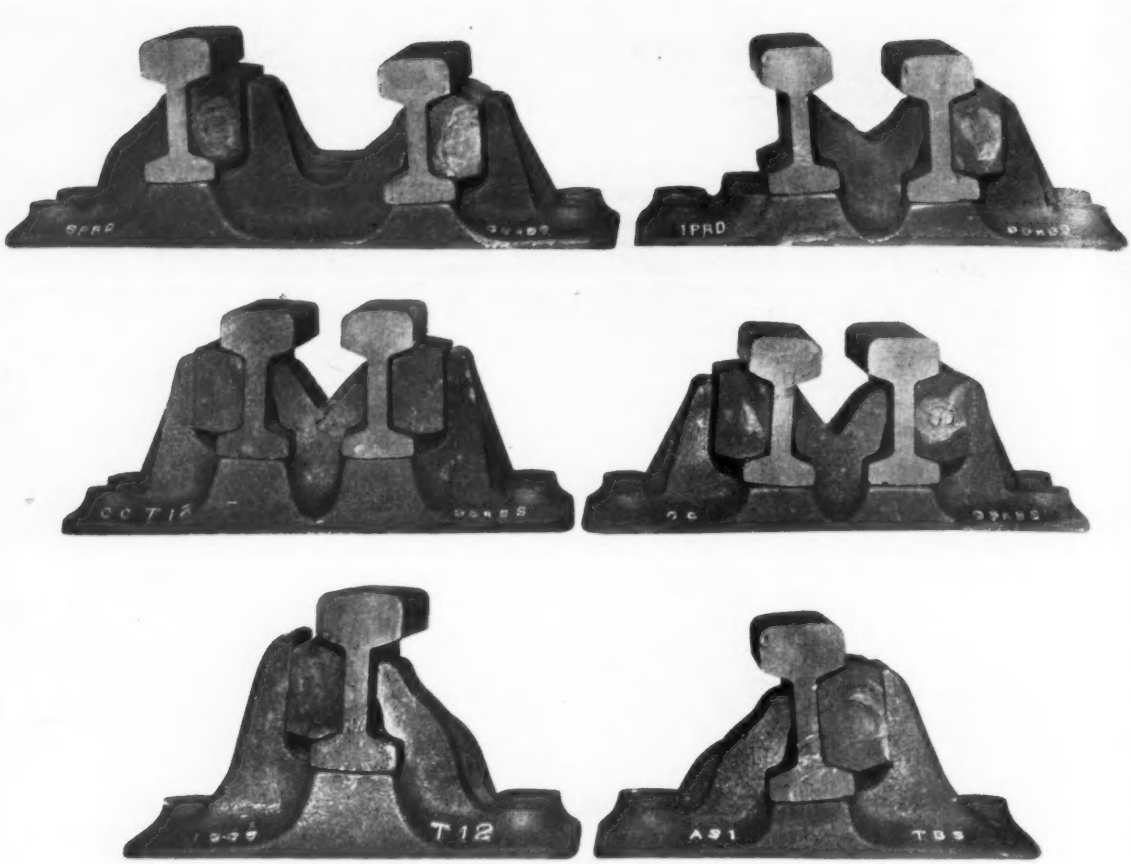


Fig. 3—(Top) *Fig. 4—(Centre)* *Fig. 5—(Bottom)*

switch and the stock in the same plane, and it became necessary to re-design these chairs, together with the slide chairs occurring after the planing, so that the switch and the subsequent switch running rail rose above the level of the stock rail.

The progression of this "lift" in the switch rail seating above the stock rail seating is shown in Fig. 2, and the gradients at which this cant is attained vary between 1 in 346 for the D switch to 1 in 440 for the F switch, there being an intermediate gradient of 1 in 433 for the E/F and the E switches. These two-level chairs are made for the following switches: D, long D, E, E/F and F, and are designed to accommodate both the old and the new switches: thus the D two-level P chairs can be used for both normal D and long D switches, similarly the E and E/F switches both fit into the E two-level chairs.

This rise in the switch beginning at approximately the heel of the planing necessitates a slight vertical set in the switch at this point, and on an F switch with its 11 P or heel chairs a rise or cant of approximately 1 in. is attained at the last heel chair. This cant, now obtained in the switch itself, is continued to the crossing by special A.S.1. road chairs. These road chairs, together with certain other chairs such as L.1, C.C., &c., are obtainable with rail seatings rising by 1/12-in. increment from 1/12 in. to 1½ in. higher than the normal.

It must be remembered that these high-base road chairs are a distinct improvement upon the older method of using hard wood or steel packings under a standard chair. Such packings left the screws out of the timber, and theoretically, if carried to excess, by raising the rail vertically they both increased the gauge and destroyed the 1 in 20 rail inclination. The A.S.1. two-level chair is no thicker at the screw holes than the standard chair and the seating is raised radially so as to preserve accurately both the inclination of the rail and the gauge.

These road chairs are designated A.S.1.T.1. $\frac{2}{L}$ to A.S.1.T.18. $\frac{2}{L}$, the number prefixed by the letter T indicating the fractions of an inch in twelfths which the chair seating is higher than normal. Other special chairs used in obtaining the cant in this manner are the C.C. and crossing chairs, all having rail seatings higher than the normal as required for the particular job in hand.

In the three photographs of two-level chairs reproduced, it will be noted that the low screw seating has been retained. Fig. 3 shows the 6 P.R.D. $\frac{2}{L}$ and the 1. P.R.D. $\frac{2}{L}$ where the switch rail seatings are $\frac{3}{4}$ in. and 11/32 in. respectively above the level of the stock rail (on the right hand side in all cases). In Fig. 4 is seen a C.C.T.12 $\frac{2}{L}$ and a normal check chair, whilst Fig. 5 shows a two-level road chair (A.S.1.T.12 $\frac{2}{L}$) against a normal A.S.1. chair.

(To be continued)

DOVER TRAIN FERRY DOCK, SOUTHERN RAILWAY

A description of the construction of the enclosed dock at Dover and the great difficulties encountered in the course of this work

As a result of exhaustive examination of the merits of various prospective terminals on the English coast for the new cross-Channel ferry, and of the various possible types of terminal—matters that are discussed in greater detail in our editorial on page 514—an enclosed dock situated as near as possible to Dover Marine station was decided upon as the best solution to the problem. The Northern Railway of France was fortunate in having at its disposal at Dunkerque a basin in which it was only necessary to build a fendered berth and connecting bridges for trains and cars, and this basin can be reached from the channel by either of two locks.

It was realised from the first that the construction of such a dock would require considerable skill, but the difficulties that actually arose, mainly due to faults in the strata of the sea bed, were very much greater than could possibly have been anticipated. No part of the coast has been the subject of more geological investigation than that in the Dover neighbourhood, but nevertheless on the site of the dock such conditions were met with as no geologist could possibly have foreseen, or which by any previous investigation could have been detected.

The Dock Walls and Foundations

Originally, it was intended to surround the site with a cofferdam consisting of a double row of steel sheet piles driven into the chalk, stiffened by cross walls and bracings and filled in between with earthwork. A certain length of the steel sheet pile walls was driven, but the heavy winter storms demolished them before much progress was made. It was then decided to enclose the area with concrete walls 25 ft. thick, and built on mass concrete foundations previously laid under water by divers, and consisting of precast concrete blocks each weighing about 7 tons bonded together in such a manner as to be impervious to water pressure. The opening in these walls left as the entrance to the dock was temporarily closed by a specially designed steel caisson 92 ft. long by 60 ft. wide by 28 ft. thick, and weighing 525 tons.

The walls were designed to form an integral part of the final work, and the proposal was to complete these walls and the foundations for the caisson, place the caisson in position and then pump out the area thus enclosed and complete the dock works, including the dock gates and the pump culverts, in the " dry " in the usual manner. During the progress of constructing the foundations for these walls, which were laid by divers in the solid chalk as deep as 50 ft. below high water level, nothing was discovered which gave rise to any misgiving that the work as outlined could not be done, but on the contrary, the chalk was found to be of a hard and consistently solid nature. When, however, the operation of pumping the enclosed area was put into effect it was found that owing to the existence of fissures in the chalk rock forming the sea bed, which were now for the first time disclosed owing to the greater pressure of the sea water outside as compared with that inside the enclosed area, the water came up through the bottom faster than it could be pumped out, and although some weeks were spent in depositing mud on the outer side of the enclosing walls in the hope that it would be sucked into the fissures and thus seal them, this device was found to be of no benefit.

Consideration was, therefore, given to the possibility of freezing a certain thickness of the sea bed and a scheme for forming a solid barrier of ice and chalk all round the dock area about 20 yards thick and 40 yards deep was devised. Leading Continental specialists in this type of work were consulted, but their advice was not of a character to inspire confidence in the result of such treatment. All other available means of dealing with the situation were explored in the light of modern engineering developments, and ultimately the method decided upon was one of an entirely novel character, as there was no precedent on which to work.

The Difficulties and Magnitude of the Task

The problem was to construct the dock, which has an internal length of 414 ft., an overall width of 70 ft., and depth of water over the cill at L.W.S.T. of 17 ft., in an area from which it was impossible to remove the water. The entrance had to be closed by two gates of the " box " or flap door type, each weighing 300 tons, which work independently of each other on horizontal hinges laid below the dock cill. The site on which the work was to be done was subject from time to time to conditions practically identical with those of the open water, and heavy seas with waves as high as 15 to 17 ft. were liable to arise at any time during a greater portion of the year.

The method of operation adopted for the excavation of the chalk rock in the dock area consisted of enclosing a dredger in the area and placing the temporary caisson in position at the entrance, thus enabling the excavation to the required depths to be carried out in still water and permitting the dredging to be done much faster than would otherwise have been possible. The chalk rock was of so tough a character that ordinary dredger buckets would not cut it and they had to be provided with the very hardest steel teeth.

The two most critical parts of the scheme were (1) the construction of the cill on which the dock gates were to be hinged, the foundations for which were 50 ft. below high water level, and (2) the construction of the pump house, the foundations of the lowest floor of which were also at about the same level as that of the cill foundations.

The Dock Cill

For the formation of the dock cill, it was decided to construct and sink a specially designed steel pontoon of ⌊⌋ shape, the two flap gates being hinged on either side of the lower horizontal base of the ⌊⌋ pontoon and the gates, when in the vertical position, closing the open space between the two vertical sides of the ⌊⌋. When in the horizontal position the gates lie flat on the dock bottom. The pontoon was built of steel plates and angles riveted together and very strongly braced. Over the vertical sides of the ⌊⌋ there is a length of 91 ft., a total height of 60 ft., and a thickness of 29 ft.; the whole of the interior of the pontoon was filled with concrete except for certain culverts and ducts which were formed in the concrete for the accommodation of pipes and other gear. The ⌊⌋ pontoon was built on land in the vicinity and fitted with the massive cast steel gate hinges before being launched. It was then lowered into the sea, towed into its place and sunk between carefully constructed guides to ensure that it would be finally in its exact position.

Actually although it weighed about 440 tons before being filled with concrete, it was within one-tenth of an inch of its correct position and level. Such accuracy entailed most precise engineering methods, careful surveying, splendid work on the part of the steelworkers, and the divers who laid the foundations.

The Pump House and Foundations

In the pump house, three sets of vertical spindle centrifugal pumps have been installed, each of 230 h.p. capacity, and capable together of dealing with a maximum of 120,000 gallons of water a minute. In order to secure the greatest possible efficiency, it was necessary that the pumps should be situated well below the lowest water level, and this involved constructing the pump chamber 102 ft. long by 40 ft. wide with the lowest floor 50 ft. below high water level. It was also necessary that this chamber, which is in the enclosed area, should be constructed under water and that when the side walls were built it should be capable of being dried out so that the culverts from the sea to the dock could be fixed and jointed in the "dry." These culverts vary from 6 to 10 ft. in diameter.

Owing to the fissured state of the sea bottom, it was essential that the floor of the pump chamber should be capable of resisting the upward pressure of the water of a head of 50 ft., or 1½ tons per sq. ft. Twenty-one steel girders, 48 ft. long and 5 ft. deep, spaced 5 ft. apart, and weighing 5 tons each, were therefore laid on prepared foundations on the sea bed. The level of the foundations had to be fixed by means of grillages formed of old rails, and the girders were lowered into place and accurately positioned by the divers. The concrete was then filled in between the girders and thus a watertight concrete floor heavily reinforced with steel girders was formed at the required depth. The inner side of the pump house walls was shuttered by steel piles, the bases of which were stepped into steel channels laid previously at a suitable distance from the ends of the girders on both sides.

The concrete floor of the pump house was laid by means of under-water "skips," the bottoms of which can be opened by the divers when lowered the required depth, thus enabling the concrete to be laid between the girders by the divers operating below. The concrete in the side and end walls of the pump house was deposited through a "Tremie Pipe," a device which enables the concrete to pass in a pipe to the required level under water without coming into contact with the surrounding water, thereby preventing the cement from being washed away. At the bottom of the pipe divers guided the concrete into its correct position.

No previous records exist of the construction of such a chamber under similar conditions, but, nevertheless, the whole operation was completely successful, and when the water from the chamber was pumped out it was found that there was no percolation whatever, even under a maximum head of 50 ft.

The upper portion of the pump house took the form of a steel-framed building with brick walls and a steel roof. It provides accommodation for the pump motors, the electrical gear controlling the operation of the main and auxiliary pumps, the valves and the special electrical generators supplying the motors for the dock gate winches.

Main Dock Walls and Floor

The main dock walls, which are 28 ft. thick, were constructed by driving two rows of steel sheet piling in the still water of the enclosed area, as shuttering for the mass concrete of the dock walls. The walls were then constructed in lengths of about 40 ft. at a time, the concrete being laid by means of "Tremie Pipes."

A concrete floor about 5 ft. in thickness has been laid over the whole area of the dock to avoid the percolation of water from the sea bed. The whole of this concrete was deposited under water and levelled off by divers, strips of the floor about 80 ft. long and 25 ft. wide being laid at a time.

Thus day and night for three years the work generally has been carried on without cessation, and for the greater part of that time practically nothing could be seen above water to indicate what was being done, as the bulk of the work was carried out in the darkness of the water of the sea.

Structures and Apparatus Necessary for the Reception of the Ferry Vessels

In addition to the dock, an approach jetty, 400 ft. long and 30 ft. wide, formed of concrete piers enclosed in steel sheet piling and with a concrete deck has been constructed, alongside which the ferry vessels will lie before entering the dock. From this jetty the vessel will be warped through the open gates, which will be lying flat on the bottom of the dock, into the berth, after which the gates will be closed and the water raised or lowered to the required level by means of the pumps. When the vessel is at the required level, connection will be made to it at the inner end of the dock by means of a bridge 70 ft. long.

This bridge will normally be approximately level, but as loading and unloading of the trains on to the vessel takes place, there will naturally be some tilting of the vessel both longitudinally and sideways. The bridge is a completely articulated structure, and will take up any difference in level caused by this tilting; it can be raised clear of the vessel when necessary. A massive steel pin at the end of the vessel will enter a recess which has been formed in the bridge, thus securing it during the operation of loading and unloading. Two lines of rail track cross the bridge so that it will be possible for two lines on the vessel to be dealt with at the same time.

The passage of all traffic between the railway lines on the shore and the vessel will be controlled by a complete electrical signalling and interlocking installation, so as to eliminate any possibility of a mishap occurring. Ordinary locomotives will be used for transferring the railway vehicles between the ferry vessel and the land.

A new ferro-concrete Customs House building is being constructed for dealing with the traffic to and from the train ferry vessels, and in this two-storey building are provided the usual offices connected with a railway station. In addition to this building a Transit Shed, also in ferro-concrete, will be part of the terminal station. It has considerable space for bonded stores and is also fitted with all ordinary modern goods shed plant. A covered hall for registration and examination of cars is being provided on the ground floor of the Customs building.

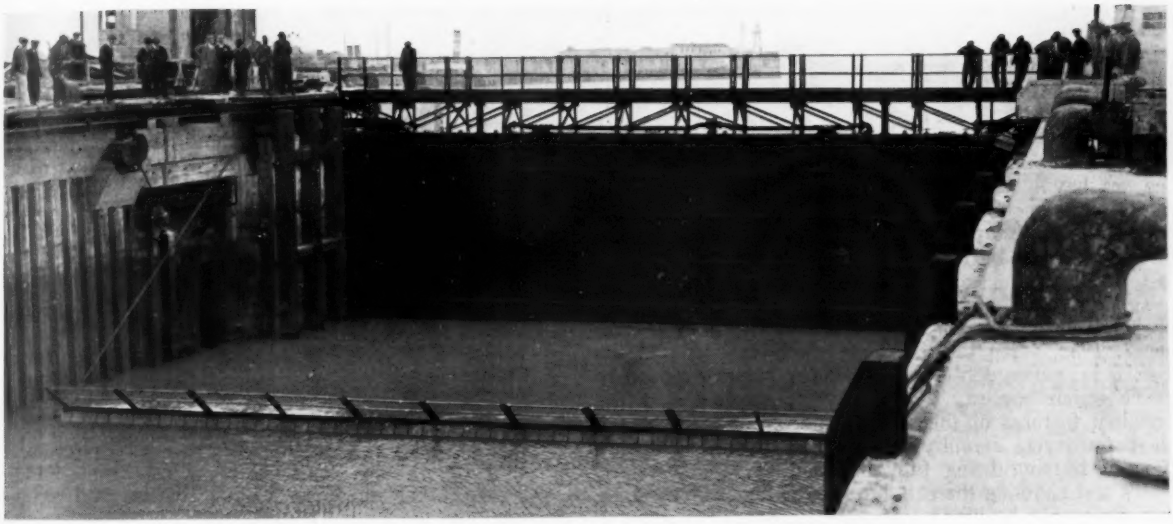
Quantities, Contractors, and Supervision

The quantities of the principal materials used in the dock works were as follow: 120,000 cu. yd. of concrete, 7,000 tons of steelwork, and 220,000 cu. yd. of dredging.

The main contractors for the works at the beginning of the contract were E. Nuttall, Sons & Co., and J. Mowlem & Co. (Joint) Ltd., but since June, 1935, the work has been completed by J. Mowlem & Co. Ltd., on behalf of the joint firm. The whole of the works have been carried out to the designs and under the supervision of Mr. George Ellson, Chief Engineer, Southern Railway.

Brief outlines of the ferry vessels, rolling stock, and methods of operating the goods and passenger ferry services are contained in our editorial on page 514.

Submerging one of the horizontally-hinged train-ferry dock gates



Gate almost entirely submerged on its way to lying flat on dock floor

The control panel in the pump house

Dover Train Ferry Dock, Southern Railway

SHEFFIELD DOUBLE FRAME WELDED 5 FT. 6 IN. GAUGE PASSENGER BOGIES FOR THE BENGAL-NAGPUR RAILWAY

A description of the first application of this type of bogie to broad gauge express passenger coaching stock

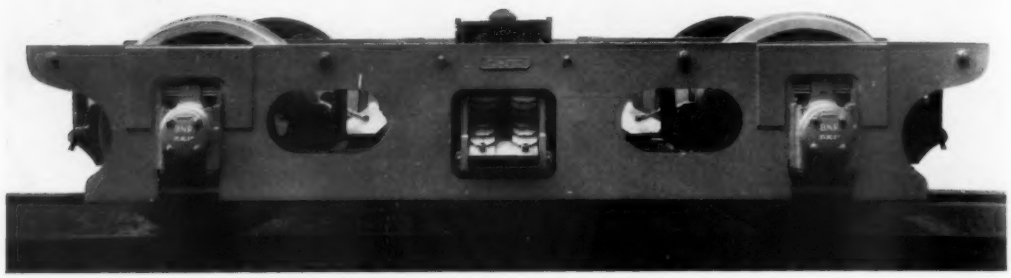


Fig. 1—Side elevation of the bogie fitted with Skefko roller bearing axleboxes

THE photographs we reproduce illustrate one of a number of heavy duty broad gauge coach bogies supplied by G. H. Sheffield & Co. (Engineers) Ltd., Westminster, for express and mail services upon the Bengal—Nagpur Railway. The bogies are designed for coaches having a gross weight of 54-56 tons, and built to the requirements of Mr. C. E. Chase, Chief Mechanical Engineer, and to the specification and inspection of Messrs. Sir John Wolfe Barry & Partners, Consulting Engineers to the railway.

The principle of the bogie and its functions were described in the issue of THE RAILWAY GAZETTE of December 7, 1934, when there was an article dealing with the 3 ft. 6 in. gauge double frame welded bogies supplied to the Nigerian Railway. It may be recalled that the principal features of this type of bogie combine to give great transverse stability with lightness, the box-girder type of framing being fully stiffened with spot welded plates and enabling the cantilevering of the ordinary axlebox springs to be eliminated. Incidentally, the extreme ease with which these springs can be withdrawn is important. The bolster spring suspension—clearly seen in one of our illustrations—the circular bearing plates with hemispherical centres for the side bearings upon the bolster (to reduce both the bending moment and hunting) and the complete absence of riveting should also be noted.

As will be seen from Fig. 1, the side elevation of one of these B.N.R. bogies, they are fitted with Skefko roller bearing axleboxes. The neat general layout and complete welding are clearly shown in Fig. 2, while Fig. 3 shows the details of the special Sheffield-Twinberrow bolster spring arrangement, with its 8-ft. spring. It is interesting to note that no spring tray is required. The principal dimensions are:—

Wheelbase	10 ft. 0 in.
Centres of journals	7 ft. 4 in.
Length over side frames	15 ft. 3 in.
Width over side frames	7 ft. 11 in.
Width of each side frame	0 ft. 7 in.
Size of journals	215 mm. × 110. mm.
Diameter of wheels	3 ft. 7 in.

The weight of the bogie without wheels and axles is 4½ tons, and the weight of the frame with all connections other than loose brake work and loose bolster is 1 ton 17 cwt. It may also be noted that in the case of these

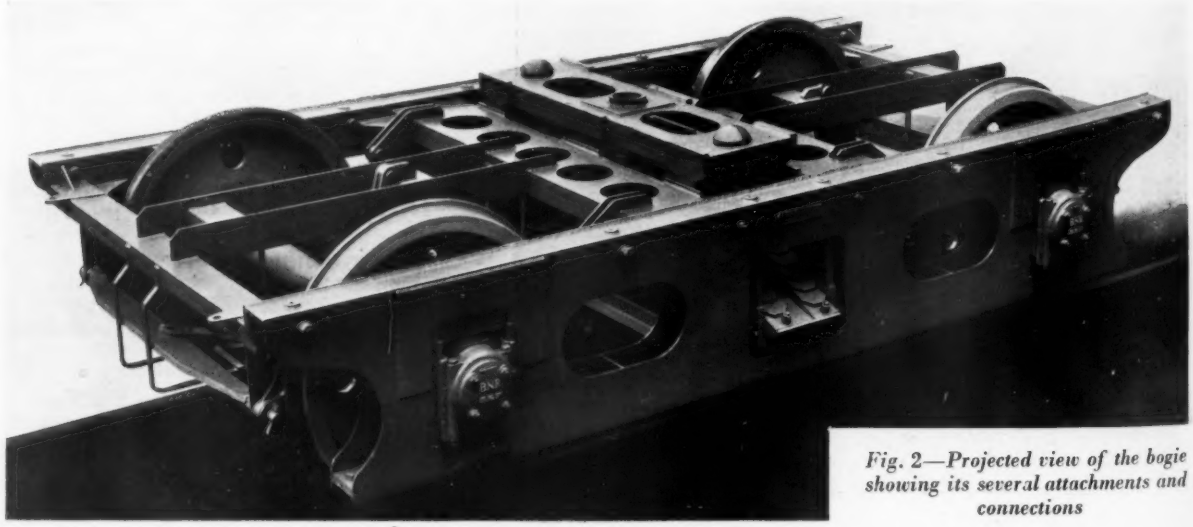


Fig. 2—Projected view of the bogie showing its several attachments and connections

bogies all redundant welding, in the form of special fabrication of details has been dispensed with, and British Standard steel sections suitably lightened, are employed for cross connections such as bolsters, headstocks, and tension members. Attention is also called to the fact that the greater part of the welding in this bogie is in the horizontal plane. The electrodes used were supplied by Murex Welding Processes Limited of London. An equalised form of brake gear is employed with two brake blocks to each wheel.

The axlebox guides are supplied with renewable slippers, 13 in. deep by 8 in. wide. A characteristic feature of this bogie is the provision of large wearing and bearing surfaces upon the horn-cheeks of the bolsters, the rounded knife edges under the volute spring cups, resting upon the laminated bolster springs and the anti-friction rollers upon the underside of which the ends of the laminated axlebox springs take their bearings.

The springs were made by Willford & Co. Ltd., of Sheffield, and the wheels and axles by Taylor Bros. & Co. Ltd., of Trafford Park, Manchester. Similar bogies have been supplied for the East Indian Railway broad gauge, and for Bombay Baroda & Central India Railway metre gauge rolling stock.

Fig. 3—Sheffield-Twinberrow bolster spring arrangement with welded details such as bolster horn-cheeks and Parobo volute spring cups, and with 8 ft. laminated bearing springs

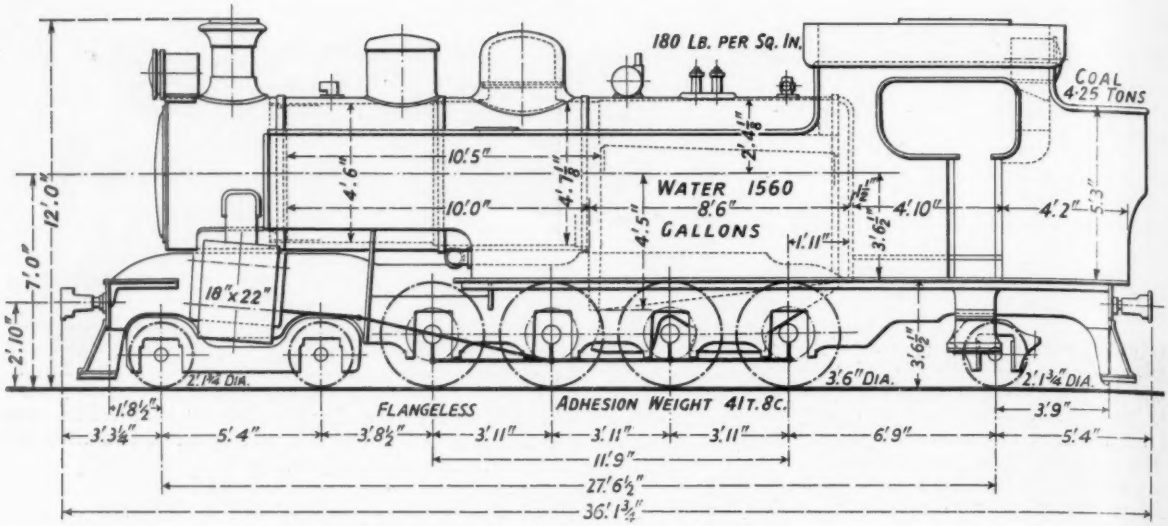
TANK LOCOMOTIVE FOR SOUTH AFRICA

This engine is being shown at the Empire Exhibition in Johannesburg

IN 1935 the North British Locomotive Co. Ltd. delivered to the Randfontein Estates Gold Mining Co. Ltd. a 3-ft. 6-in. gauge tank locomotive of the 4-8-2 type, specially designed for industrial service and for districts where axleloads must be restricted to about 10½ tons. An additional locomotive, a duplicate in every respect of that now in service, was recently shipped to South Africa and will be on view at the Empire Exhibition, Johannesburg (September, 1936-January, 1937), in the pavilion of Reunert & Lenz Limited, the builder's agent in South Africa. At the close of the exhibition, this locomotive will be acquired by the Randfontein Company.

In working order, the engine, which we illustrate, weighs 62½ tons, and has an adhesive weight of 41½ tons. The cylinders are placed outside the frames and drive the second pair of coupled wheels. They are fitted with 9-in. diameter piston valves. Cylinder lubrication is effected by means of a 4-feed sight-feed lubricator. Walschaert

4-8-2 locomotive built by the North British Locomotive Co. Ltd., for industrial service on 3 ft. 6 in. gauge lines



TOTAL WEIGHT IN WORKING ORDER = 62 T. 10 C.

Leading dimensions and weights of new 3 ft. 6 in. gauge industrial locomotive for South Africa

valve gear and steam reversing gear are fitted. The boiler, which is of the round top type, is equipped with two Gresham & Craven No. 8 self-acting injectors delivering through top feed valves. A rocking fire grate is provided, with drop plate at front end operated by hand from the footplate. Air spaces are arranged between the foundation ring and the side plates of the ashpan. Sliding doors are fitted on the bottom of the ashpan, but damper doors are not provided. The frames are of plates $1\frac{1}{8}$ in. thick with cross stretchers of plating. The smokebox saddle, slidebar brackets, and motion girders, &c., are of fabricated construction, and the tanks and bunker are also welded throughout.

Hand and vacuum brake gear actuate blocks on all coupled wheels. Electric lighting equipment is provided. The leading particulars are as follow:—

Cylinders (2), diameter	18 in.
,, stroke	22 in.
Wheels, coupled, diameter	3 ft. 6 in.
,, bogie and truck, diameter	2 ft. $1\frac{3}{4}$ in.
Working pressure	180 lb. per sq. in.
Heating surface:	
Tubes	1,079 sq. ft.
Firebox	116 ,,
Total	1,195 ,,
Grate area	17·25 ,,
Tank capacity	1,560 gallons
Fuel (coal)	$4\frac{1}{4}$ tons

Weed Killing on the Reichsbahn

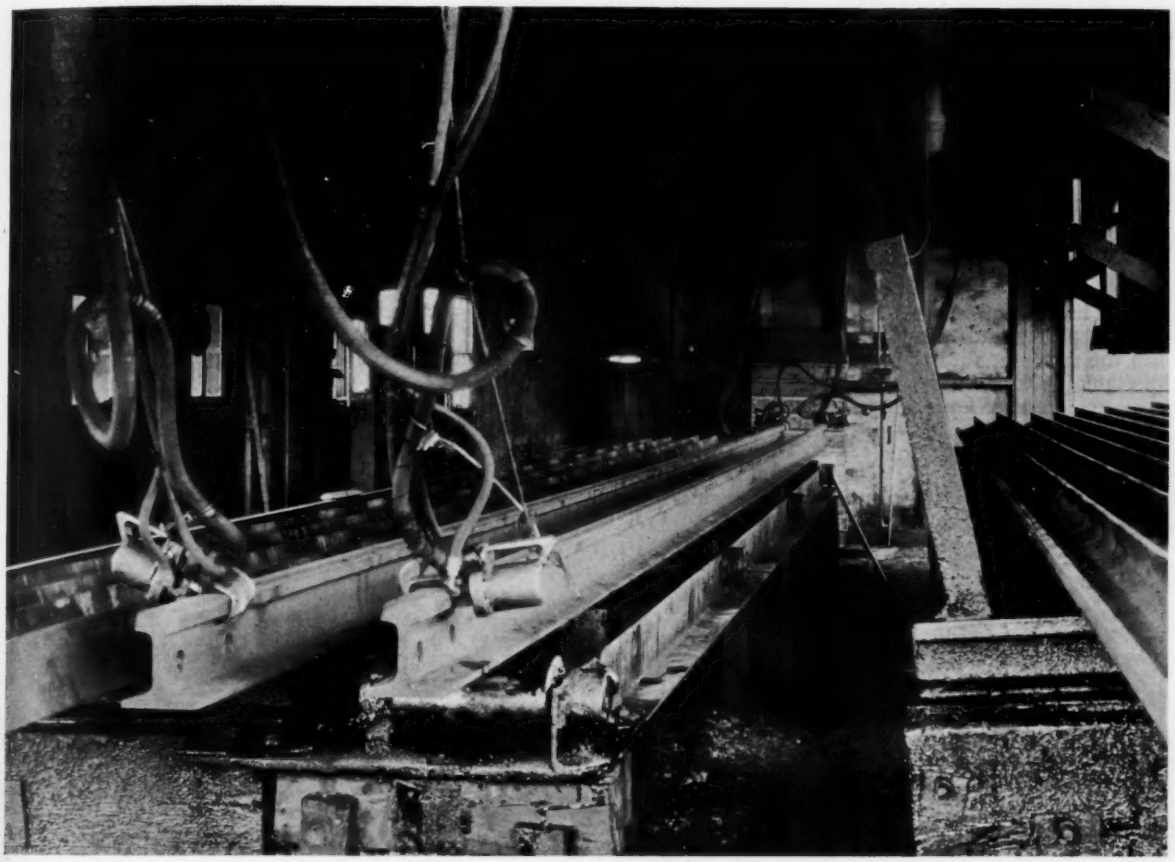
On April 4, 1934, the German State Railway introduced the method of destroying weeds along its tracks by spraying with chlorate of sodium. Formerly the liquid weed killer was distributed by gravity from pipes leading from a tender, but under the present method it is pumped into the pipes and sprayed through very fine nozzles, as shown in the picture alongside, a proceeding found to be both more effective and cheaper. The spraying is carried out early in the year, but not until the weeds have had a chance to show themselves, and generally work begins in April or May, before the seed has ripened. If the first spray does not prove sufficient, a second is given not less than 14 days later. The weed-killer trains are composed of obsolete tenders, connected by conduits. We refer to this subject in an editorial note on page 513.

DETECTING RAIL DEFECTS AT PERMANENT WAY DEPOTS

Stationary electrical detection equipment, similar in principle to that of the travelling detector cars, installed at the Verona rail-sawing plant, Pennsylvania Railroad

IT is the custom in America and other countries using flat-bottomed rails to recondition worn rails by cutting off the battered ends, re-drilling, and relaying the shorter lengths so produced in subsidiary tracks. Alternatively, after cropping the ends, the short rails may be welded in pairs into longer lengths. Opportunity is now being taken by certain American railways of incorporating Sperry detection of internal fissures in the work of reconditioning in order to intercept, if possible, rails which might fail after relaying, and also to avoid wasting labour on rails that are defective. For example, the Pennsylvania Railroad has installed a stationary detector unit in its large rail-sawing plant at Verona, Pa., where practically all the reconditioning of worn rails is done for the Central Division of the railway. The principle of operation—that of forcing a heavy uniform current through the rail, and then passing a specially-designed electrical instrument over the rail-head, in order to detect changes in the amount and direction of the magnetic flux which occur when either external or internal defects are present—is the same as that used in the travelling detector cars, but the method of application is different.

On arrival at the depot, the worn rails are intercepted as they pass along the skids from the incoming wagons to the saws, and are dealt with two at a time. Over the heads of the operators are two pairs of counterweighted electrical rail-clamps, which are brought down on to the two extreme ends of each rail directly the rails have been skidded into position. Through these clamps, which are held firmly in position by air-operated plungers, a 12-volt 2,000-amp. electric current, supplied by a small motor-generator set located in an adjacent shed, is passed; and the clamps are so designed that a small stream of water is passed through them on to the rail at the same time for cooling purposes, for considerable heat is produced at the contact points. An ammeter prominently located near the operator shows if the full current is passing through the rail, and if not the clamps are jolted, and the arcing thus deliberately set up burns clean points of contact with the railhead. The detector



Two rails ready for simultaneous treatment, showing the electrical clamps at each end between which the current passes

unit itself is in the form of a small hand-operated sled, which rides on four non-magnetic runners, so that there is no actual electrical contact between sled and rail, but the bearing ensures a constant relation between the rail-head and the electrical elements of the detector. The latter consist of suitable coils for detecting any changes in the intensity and direction of the magnetic flux produced in the rail by the flow of current. These changes, when encountered, set up an induced current in the circuit of the detector sled, which. after amplification, is brought back to operate a small ½-watt, 125-volt Neon lamp mounted on the top of the sled. The wire connections to the sled are made by a trolley arrangement above the operator's head, which moves along above him, so keeping the wires out of his way.

As the sled is moved along the top of the rail at a walking speed, flashes of the lamp indicate the presence of a defect, and the intensity of the flash gives a fair indication of its magnitude. Directly a flash is seen, the sled is moved backwards and forwards over the place so that the nature of the flash may be studied. If surface blemishes are present in sufficient degree to explain it, unless such defects are serious enough to justify rejection of the rail, the sled is moved on; but if the flash is held to indicate a fissure, the rail is pushed through an opening out of the building, so that the work in the shed may not be interrupted.

The suspicious rails are dealt with later on in groups, when the rail-saws are not functioning. For this purpose a portable galvanometer is used, provided with contact fingers which permit the precise location of the electrical disturbance. If there is reason to suspect that this is caused by a fissure, the rail is branded, and a certain proportion of these rails is broken at the point so indicated, in order that the defect may be studied in relation to the indications that it gave on the sled, for future guidance.

Actual operation of the detector is in the hands of one man, the detector sled operator, who has two helpers to pull the incoming worn rails over the skids into position, and to attach and detach the clamps. At the point of testing, 5 ft. back from the roller train leading to the saw, an aisle has been cut through the skids to enable the operator to move from one end of the rails to the other. Special counterweighted arms bridge the gap as each pair of rails is moved across it on to the test bench, and then rise automatically out of the way. In the ordinary course, the detection of a couple of rails is completed in from 30 to 40 seconds, so that the rails can be passed through the work of detection more rapidly than they can be sawn, and no slowing-down of the work of the depot has followed the introduction of the detection appliances and staff. By their use, there is greater confidence in the worn rails that are sent out from the depot for re-use, and some considerable time can be allowed to elapse before the detector car is sent over that particular stretch of line. A similar plant is now in use in France, at the Saulon depot of the P.L.M. Railway, and is the first of its kind to be installed in Europe.

A South Wales to London Coal Train

Striking view, from a photograph by Mr. G. H. Soole of a Great Western Railway coal train, headed by 2-8-0 *locomotive No.* 2810. *The picture was taken near Patchway when the train had emerged from the Severn tunnel en route from South Wales to London*

RAILWAY NEWS SECTION

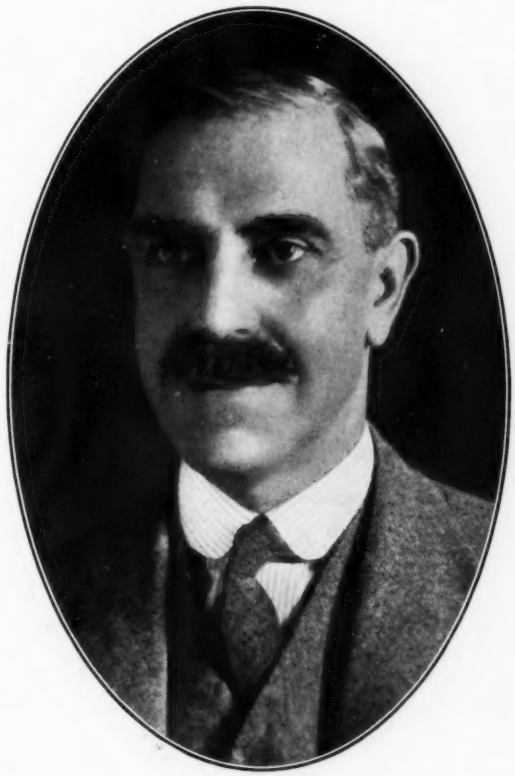
PERSONAL

Sir Edward Beatty, President of the Canadian Pacific Railway Company, has issued the following official statement: "Sir George McLaren Brown will retire on October 31 after almost 50 years of service with the Canadian Pacific Railway, during the last 28 of which he has represented the company in London as European General Manager. He retires under our pension rules and will be succeeded by Mr. J. C. Patteson with the title of European Manager. The executive of the company naturally regrets Sir George's retirement, as he is an exceptionally popular and zealous officer, and extraordinarily conscientious in his efforts to satisfy the company's patrons. His successor has held many positions in Canada and the United States."

We regret to learn of the death, on September 15, of Brig.-Gen. Sir William Danvers Waghorn, Kt., C.B., C.M.G., formerly R.E. and sometime President of the Indian Railway Board. Born in 1867 he was commissioned to the Royal Engineers in 1887, and joined the Indian State Railways two years later, in the Engineering Department. He saw service on The Frontier, and also throughout the South African war as Deputy Assistant Director of Railways. In 1908 he was promoted to be Deputy Manager of the North Western Railway (India), and after work upon the Nigerian and Gold Coast railways (1911-12), was made Agent of the former Oudh & Rohilkhand Railway. He was appointed Deputy Director of Railway Construction in 1915, and Agent of the North Western Railway in 1916. During the war he was successively Deputy Director of Railway Transport and of Railway Construction, and Chief Engineer of the 17th Corps on the Western Front. He was made a C.M.G. and C.B., and received the Croix de Guerre and Legion of Honour. After the war Sir Danvers was appointed a Member of the Railway Board in 1919, and later was President for three years; he was knighted in 1923 and in 1924 retired with the rank of Brigadier-General.

Mr. John Wilson, O.B.E., General Manager, Entre Rios and Argentine North Eastern Railways, returned to Buenos Aires on August 25, after several months' leave in Europe.

Mr. W. A. Stanier, Chief Mechanical Engineer, London Midland & Scottish Railway, who, as the new President of the Institution of Locomotive Engineers, delivered his Presidential address on Wednesday, is the son of the late Mr. W. H. Stanier, Chief Stores Superintendent, G.W.R., and was born in 1876. He was educated at Wycliffe College, Stonehouse, and entered the Swindon works of the G.W.R. as an apprentice in 1892. After serving his apprenticeship he became a draughtsman, and in 1900 was appointed Inspector of Materials; the following year he was transferred to the Running Department as Technical Inspector at Swindon running shed. At the beginning of 1903 Mr. Stanier was promoted to be Assistant Divisional Superintendent, Swindon Division, and a year later was moved to Paddington in a similar capacity. In 1906 he returned to Swindon as Divisional Locomotive Superintendent, the position he held for six years. At the beginning of 1913 he was appointed Assistant Locomotive Works Manager at Swindon, and became Works Manager in 1920. Two years later he was appointed Works Assistant to the Chief Mechanical Engineer, and in 1923 was promoted to be Principal Assistant to the C.M.E., the position he held until the end of 1931, when he was offered and accepted the appointment of Chief Mechanical Engineer of the L.M.S.R. at Euston. Mr. Stanier is a Member of Council of the Institution of Mechanical Engineers.



Mr. W. A. Stanier,

Chief Mechanical Engineer, L.M.S.R., President of the Institution of Locomotive Engineers, 1936-37

We regret to note the recent death of Mr. James Fraser, a former Chief Commissioner of the New South Wales Government Railways, at the age of 74. He entered the railway service in 1880 as an engineer cadet, and rose to be Chief Engineer before becoming Commissioner.

Mr. Thomas Hornsby, who, as recorded in our issue of August 14, recently retired from the position of Divisional General Manager of the North Eastern Area, L.N.E.R., on his appointment as Independent Chairman of the Durham Coal Sales Control Committee, was entertained to dinner at the Royal Station Hotel, York, by present and past officers of the railway, on Friday, September 25. Mr. C. M. Jenkin-Jones, who has succeeded Mr. Hornsby as Divisional General Manager, presided, and Sir Ralph Wedgwood, the Chief General Manager, presented to Mr. Hornsby a silver tea and coffee service and silver spirit kettle on behalf of his former colleagues, and an English lacquer clock for Mrs. Hornsby. Mr. C. M. Jenkin-Jones, Divisional General Manager, Mr. Paul Gibb, Goods Manager, and Mr. S. T. Burgoyne, Superintendent, supported the toast of the health of Mr. Hornsby proposed by Sir Ralph Wedgwood. The toast of the health of the retired officers of the company, many of whom were present, was proposed by Sir Nigel Gresley, Chief Mechanical Engineer, and responded to by Mr. Alexander Wilson, who served as Divisional General Manager in both the North Eastern and Southern Areas of the L.N.E.R. Prior to the dinner, the staff of the Divisional General Manager's office presented to Mr. Hornsby a gold-mounted fountain pen and gold pencil, and a gold pencil for Mrs. Hornsby.

Mr. B. L. Daly, Conductor, of Winnipeg, has been selected by Canadian National Railways employees as their representative on the new

C.N.R. Board of Directors. This appointment was referred to in our Overseas columns last week. Mr. Daly was chosen at a closed meeting of union chairmen held in Montreal and his name forwarded to the Minister of Transport prior to publication. The choice has been confirmed by Order-in-Council of the Governor-General. This is the first time in Canadian railway history that labour has nominated its own representative to a directorate. Mr. Daly is the General Chairman of the Order of Railway Conductors, C.N.R., Western Region, and is the Secretary of the General Chairman's Association. He has had considerable service with the C.N.R. and has been active for many years in railway labour affairs. Since 1931 he has been Secretary of the employees' wages negotiating committees, and a representative of the C.N.R. employees on several joint committees of management and labour.

Mr. Ernest Bevin, General Secretary of the Transport and General Workers Union, has been elected Chairman of the General Council of the Trades Union Congress for the ensuing year and President at next year's Congress. Our Staff and Labour Correspondent refers to Mr. Bevin's appointment on page 541.

We regret to learn of the death, on September 22, of Dr. Dietrich Schindler - Huber, Chairman and Delegate of the board of administration of the Atéliers de Construction Oerlikon, after a short illness, in his 81st year.

Mr. P. St. J. Bishop, late Divisional Engineer, Central Division, Southern Railway, whose death we announced in our issue of June 26, left estate valued at £56,330.

Major J. A. W. O'Neill Torrens, Chairman of the L.M.S.R., Northern Counties Committee (Ireland), whose death we announced in our issue of April 3, left estate valued at £18,454.

Mr. Herbert Paterson, late Director of Carter Paterson & Co. Ltd., whose death we announced in our issue of June 19, left estate valued at £117,034.

It is with regret that we learn of the death, on September 21, of Mr. John William Gordon, K.C., who, as well as being a lawyer, was Hon. Sec. of the Royal Microscopical Society (1909-11) and of the Optical Convention (1912). He was awarded the Gold Medal of the Society of Engineers for a paper on railway surveying by photography.

We regret to record the death, on September 28, of Brigadier-General Sir Brodie Haldane Henderson, K.C.M.G., C.B., senior partner in the firm of Livesey & Henderson, Consulting Engineers to most of the principal Anglo-South American and other railways; Chairman of the Central Uruguay of Monte Video, Midland Uruguay and Associated Lines; and Past-President of the Institution of Civil Engineers. He was born in 1869, and was the younger brother of the first Lord Faringdon. During the war he received a commission in the Royal Engineers and rose to be Deputy Director General of Transportation; he retired from the Army with the rank of Brigadier-General after being mentioned in despatches several times, decorated with the orders of Commander of the Crown of Belgium, Officer of the Legion of Honour and the Croix de Guerre; also with the C.M.G. in 1918. In 1919 he was made a C.B., and promoted to K.C.M.G. in recognition of his services. Sir Brodie served on the Commission of the Peace, was High Sheriff of Hertfordshire in 1925, and was also a Deputy Lieutenant of that county. He was elected President of the Institution of Civil Engineers, 1928-29, and, as senior partner in his firm, which designed and supervised the building of the great Lower Zambezi Bridge—opened for traffic early in 1935—he visited the site and inspected the work upon it. The funeral took place yesterday at Braughing Church, Herts, and a memorial service will be held at St. Michael's, Cornhill, today, October 2, at noon.

The late Sir Brodie Haldane Henderson, K.C.M.G., C.B.,

Senior Partner; Messrs. Livesey & Henderson, Consulting Engineers

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Mr. Percy Wheeler, a Director of the Associated Equipment Co. Ltd., and sometime Director of the Metropolitan-Cammell Carriage Wagon & Finance Co. Ltd., left estate valued at £48,529 (£44,468 net).

Driver G. Haygreen, who was in charge of *Silver Fox*, the engine on the L.N.E.R. Silver Jubilee train when it attained a record speed of 113 m.p.h. on August 27 last, has now retired after 40 years' service, 34 as driver.

From the *London Gazette* of September 22: Regular Army, Corps of Royal Engineers: Lt.-Col. C. F. Carson, M.C., on completion of four years as Regimental Lt.-Colonel, is placed on the half-pay list (employed) (September 22). Lt.-Col. Carson is officiating as Agent of the North Western Railway, India.

From the *Gazette of India*, Defence Department, August 1: The Viceroy and Governor-General has been pleased to make the following appointment to His Excellency's personal staff:—to be Honorary Aide-de-Camp: Lt.-Col. F. R. Hawkes, O.B.E., V.D., North Western Railway Batt'n A.F. (I), and is granted the honorary rank of Colonel on appointment (July 8). Colonel Hawkes is Chief Commercial Manager, N.W.R.

INDIAN RAILWAY STAFF CHANGES

Mr. W. H. H. Young has been confirmed as Chief Commercial Manager, E.I.R., as from November 30 last.

Mr. N. D. Calder has been appointed to officiate as Traffic Manager, E.B.R., as from August 3. Mr. L. W. Van Someren, officiating Traffic Manager, reverted to his substantive post of Deputy Traffic Manager on that date.

Mr. W. C. Cartland, Deputy Chief Engineer, Signals, E.I.R., retired from Government service on August 5.

Mr. W. T. Griffiths has been confirmed as Deputy Agent (Staff), G.I.P.R., as from December 11 last.

Mr. G. S. Bocquet, Traffic Manager, E.B.R., has been permitted to retire from Government service as from August 13.

Mr. H. D. Furley on return from leave has resumed his duties as Chief Operating Superintendent, N.W.R. Mr. C. C. T. Brereton, M.B.E., on relief by Mr. Furley has been ap-

pointed Divisional Superintendent, Lahore Division.

Mr. Robert Holland Martin, C.B., Chairman, Southern Railway Company, has accepted the invitation of the Retired Railway Officers' Society to attend the autumn luncheon to be held at 12.45 on Tuesday, November 10, in the Middlesex Suite, Abercorn Rooms, Great Eastern Hotel, Liverpool Street, London, E.C.2.

Sir Harold Hartley, C.B.E., F.R.S., a Vice-President of the L.M.S.R., has been re-elected Chairman of the International Executive Council of the World Power Conference, to hold office until the next plenary meeting.

The London & North Eastern Railway announces that Mr. H. H. Swift has been appointed Assistant Electrical Engineer as from October 1.

Manchester and Altrincham Electrification

Précis of a paper by Mr. F. W. Wheddon

At the first meeting of the session of the L.N.E.R. (Great Central Section) Debating Society, held at Nottingham on September 26, Mr. C. H. Newton, Divisional General Manager, Southern Area, L.N.E.R., presided, and a paper dealing with the Manchester South Junction & Altrincham Railway electrification was read by Mr. F. W. Wheddon, District Passenger Manager, Manchester, which also embraced observations on the general question of electrification in the Manchester area.

Mr. Wheddon reviewed the historical development of the line, which serves an important residential district, and illustrated how a lucrative passenger traffic had been created under steam conditions by the provision of good train services. In 1903 road competition was first encountered in the shape of tramway competition, followed in the post-war period by intensive motor-bus services, which had the effect of reducing local passenger revenue to a serious extent, notwithstanding the fact that improvements in rail service and reductions in fares were introduced. He pointed out that, immediately prior to electrification, intensive competition on the part of municipal and private road operators led to the abstraction of rail passengers at the rate of one million per annum. The nature and scope of various investigations into the question of electrification of the M.S.J. & A. Railway were explained, and Mr. Wheddon stated that after review of the whole position, the commercial opinion was that under electric operation an increase of 100 per cent. in local passenger traffic could be anticipated over a comparatively short period, due regard being paid to recovery of traffic from road and the potentialities of the area for housing development.

The electric service began in May, 1931, and before a single electric train was run it became apparent that road competition had increased to such an extent as to jeopardise the new capital sunk in the electrification scheme. Coincident with the opening of the M.S.J. & A. electric service, the Traffic Commissioners held their first sittings in Manchester, and the owners of the railway raised strenuous opposition against the whole of the road services on the Manchester—Altrincham route, which runs parallel to the line, on the grounds of wasteful competition, also urging that a measure of protection should be given to railway capital. As a result, road fares were raised, the municipal bus services were reduced from the status of express buses to "pavement services," with consequent increase in the overall journey times, whilst the "pirate" operator was eventually eliminated.

Results of Electrification

Turning to the results achieved by electrification, Mr. Wheddon pointed out that in the last year of steam working, the total of local passenger journeys was 5,033,643, and at the end of the fifth year of electrical operation this number had increased to 9,521,297, or 89 per cent. Traffic still continued to increase, and there was justification for the belief that the anticipated accretion would be fully achieved. Local revenue likewise showed good improvement, to the extent of 76 per cent. over a similar period, and after allowing for the increased cost of working there was a satisfactory return on the new capital employed.

On the general question of electrification in the Manchester area, Mr. Wheddon referred to the scheme which had been agreed for electrifying the main line between Sheffield and Manchester (London Road and Central stations), including the Glossop branch, and stated this was bound to have an important bearing on the problem. On the completion of this scheme, there would remain only short sections of line, totalling 13½ route miles, to be wired for overhead power distribution to bring the most important L.N.E.R. suburban services within the scope of the complete scheme. It was hardly necessary to point out, Mr. Wheddon continued, how complex was the problem of electrification in the Manchester area. An investigation of all its various phases made it clear that operating conditions over the network of lines serving such a busy industrial area in which freight train working played a predominant part, were such as to cause serious reflection. What had been said of the difficulties concerning lines owned, or jointly owned, by the L.N.E.R., applied with equal if not greater force to other railways radiating from Manchester. To admit of augmented suburban services in peak hours and regular frequency throughout the non-peak periods, the provision of additional tracks, and a good deal of re-signalling would become a necessity, and consequently the capital cost entailed would be on a correspondingly large scale.

Reverting to the M.S.J. & A. experience, he said it had to be remembered that immediately electrification was decided upon, competition was seriously intensified against the railway, and since electric services were put into operation road facilities had been further increased without apparent justification, which had tended to retard the growth of rail revenue. In such circumstances it was not to be expected that the railways would be prepared to sink further capital on electrifying local services when they were likely to be faced with the possibility of seeing that capital unremunerative.

South Lancashire Co-ordination

Representations had been made to the railway companies on behalf of the Regional Town Planning and the Manchester Corporation Underground Committees, urging the need for electrification as a solution of their transport problems, but in response it had been made clear that the railways were not prepared to consider projects of this kind unless full protection were given to the capital employed, and that in the opinion of the railways such protection could be afforded only by the establishment of a co-ordinated system of rail and road transport, including both municipal and private operators. This visualised the setting up of a transport board similar to the London Passenger Transport Board, under the ægis of which co-ordination of rail and road facilities in the London area was being achieved, together with the elimination of wasteful competition.

Recently the proposed merger of the transport undertakings of ten municipal authorities operating road services in the Manchester district, conceived in optimism, had faded away in the fear that loss of local control would be damaging to prestige. Now that the railways had made known publicly what their attitude was, it would be interesting to observe whether there was any possibility of the municipalities responding in such a manner as would admit of transport and other relevant problems being solved satisfactorily. In this particular area, Mr. Wheddon concluded, there was greater density of population than in any other part of the country, and great as were the traffic potentialities of today, they would undoubtedly increase with the establishment of a co-ordinated system of transport, designed and developed to meet modern requirements in the interests of the travelling public.

Recent Development of Locomotive Design

Presidential address by Mr. W. A. Stanier to the Institution of Locomotive Engineers

At a meeting of the Institution of Locomotive Engineers, held on Wednesday evening last, September 30, Mr. W. A. Stanier, Chief Mechanical Engineer, L.M.S.R., was formally inducted as President of the institution for 1936-37.

Mr. W. Cyril Williams, on behalf of the members of the institution, proposed a vote of thanks to Mr. A. C. Carr, the retiring President. He spoke of the very great interest that Mr. Carr had shown in the well-being of the institution, and remarked upon his high reputation as a locomotive engineer. Mr. E. C. Poultney seconded the proposal, and fully endorsed all that Mr. Williams had said.

Mr. Carr, in thanking the members of the institution, said he wished especially to express his gratitude to Major H. A. Harrison, the Secretary, for all the help he had given him during his year of office. Speaking of his presidential visits to provincial centres, he said he thought that these did much to help these centres to maintain contact with headquarters in London. Mr. Carr also drew attention to the fact that there were now members of the institution in 32 different countries overseas.

Mr. Stanier announced that he had chosen for his address as President of the institution the subject of the development of locomotive design during recent years for the reason that to locomotive men during the last five years, the improvement in trade and the development of other means of transport had resulted in a general speeding up on the railways, and there had also been a desire to show that the steam locomotive was not only capable of running heavy trains at a good average speed, but, given a suitable load, could make as good a showing as the new light trains with internal-combustion-engined power units. In addition, there had been a general desire to increase the average speed of all trains, with the need of a greater number of fast goods trains.

These requirements had been met in all countries, and locomotive engineers had made much progress in developing types of locomotives to meet the conditions. So far as high speed running was concerned, no one had done more than Sir Nigel Gresley, a former President. He had shown the world that given a suitable load and path, his Pacific engines could put up records that were second to none. This wonderful achievement was made possible because of the care taken and the experience shown in the boiler and engine design, and the skill and experience of those who built the locomotive to ensure reliability in service.

Up to the present, the general practice was to design locomotives on conventional lines. The boilers had usually been designed for a working pressure of 300 lb. per sq. in. or under, but there had been a marked increase in firebox volume, grate area, and an improvement in tube ratios. The engines had had cylinders designed with better steam passages and larger steam pipes, and the valve gear had been arranged with longer valve travel.

In this country, Mr. Stanier remarked, his old chief, the late G. J. Churchward, commenced building engines with long valve travel and large steam passages in 1900, when engine No. 100 was built on the G.W.R., and for many years that company's engines were noted for their free running and capacity for speed and work. Even now, some of Mr. Churchward's engines ran the Cheltenham Flyer, which had had a very long reputation for high speed as between Swindon and London. Many experiments had been made with engines having ultra high pressure boilers. In Germany, France, America, and Great Britain the Schmidt—Henschel type of boiler had been employed, this having a closed circuit with a pressure of 1,600 to 1,800 lb. per sq. in. and producing steam at from 850 to 900 lb. per sq. in. Matters had, however, not progressed very far.

Turbine-driven Locomotives

Another attractive experiment had been to apply a turbine as a power unit, and a number of engines had been developed embodying this feature. Most of them had been fitted with condensers, and he ventured to suggest that these auxiliaries had been the principal stumbling block to successful results. Last year, the L.M.S. Railway in collaboration with Metropolitan-Vickers built a locomotive fitted with the Ljungstrom type of non-condensing turbine, similar to one that was already running on the Grangesberg-Oxelosunds Railway in Sweden. The engine in Sweden was a 2-8-0 for working heavy iron ore trains, whereas the L.M.S.R. engine was a 4-6-2 for heavy and fast passenger trains. This latter engine had been working regularly between Euston and Liverpool and back for twelve months, and had worked trains to Glasgow and back. Apart from a little trouble with the reverse turbine which had been put right, it had worked most successfully. Whether it would attain the expected results as far as economies were concerned, remained to be seen. This engine was the first in this country to be fitted with roller bearings to all axles.

A turbine was ideal for continuous working, but whether it would work efficiently under the variable conditions called for in ordinary train working could only be ascertained by actual test. It might easily be that one or two station stops or checks would upset all the economies obtained in running. The reciprocating engine was eminently suited to meet the varying conditions which occurred in ordinary train working. The simplicity and flexibility of the locomotive in this form combined with the fact that its intrinsic characteristic, as represented by the tractive effort speed curve, was exactly what it should be for railway work. It had a high value for a wide range of slow speeds when it was required for starting trains and fell away at high speeds, when a high tractive effort was not required. This characteristic was the result of the expansive properties of steam and of direct drive, unobtainable without complication from any other form of power; it made the reciprocating steam locomotive almost unassailable against the progress of time and its competitors.

Valve Gears in Use

Dealing next with the subject of locomotive valve gears Mr. Stanier stated that in the latest arrangement on the 4-6-2 engines of the L.M.S.R. all the motion pins had needle roller bearings, except the return crank which had a radial ball bearing. This arrangement was expected practically to eliminate wear in the joints of the gear; it only required greasing once a month and so reduced attention by the engine crew. Every effort should be made to reduce the weight particularly of the piston valves themselves, and to this end aluminium heads had been tried, but were not altogether successful owing to the grooves in the heads becoming wider. Poppet valves operated by cams either through Walschaert gear or through a rotary gear drive had been developed and had the advantage of lightness of valves. On some railways they were found to have advantages over piston valves.

In Great Britain, locomotive boilers were still of the conventional design, and the highest pressure was 250 lb. per sq. in. A great deal of investigation of the boiler proportions had been carried out, and there had been a greater tendency to build boilers with larger grate areas and bigger fireboxes. Unfortunately, the English loading gauge restricts the size both of boiler and engine design; a width of 8 ft. 9 in. over cylinders and 13 ft. 3 in. high limits the proportions, and the weights on axles limit the weights of the various parts to much more modest dimensions than many engines on the Continent and in America.

Six lantern slides had so far been used to illustrate some of the special types of engines and features of design commented upon in the address, these being later followed by a further selection covering other types and details of design including some interesting diagrams and graphs.

Continuing, Mr. Stanier pointed out that in regard to locomotive boiler

design the following features deserved particular attention. (1) The grate area should be of sufficient size to ensure an average rate of combustion of about 50 lb. of coal per sq. ft. of grate per hour. (2) There should be ample firebox volume to ensure combustion before the gases entered the tubes. (3) Ample free area for both the superheater flue tubes and boiler tubes and a suitable ratio for the superheated steam were required without prejudicing the steaming properties of the boiler. (4) Suitable evaporating heating surface and proportion of length to bore of tubes, so that the passage of gases is not unduly retarded through the tubes. (5) Good air space through the grate was essential; many modern grates had from 48 to 54 per cent. air space to grate area. (6) Design of smokebox arrangement.

Modern Boiler-Steel Characteristics

To enable boilers of the largest possible size to be built, it was necessary sometimes to use higher tensile steel plates than are normally used, and a number of railways had built boilers using a steel containing about 2 per cent. of nickel with the following analysis:—

Carbon ...	... 0·2 per cent.	to 0·25 per cent.
Silicon ...	... 0·1 ,,	,, 0·15 ,,
Manganese	... 0·5 ,,	,, 0·7 ,,
Sulphur	... 0·04 ,,	
Phosphorus	... 0·04 ,,	
Nickel ...	... 1·75 ,,	,, 2·00 ,,
Physical Tests:		
Tensile ...	... 34 to 38 tons per sq. in.	
Yield ...	... 17 to 19 ,,	,,
Elongation	... 22 per cent.	to 24 per cent.
Reduction on area ...	... 50 ,,	

This material enabled a reduction to be made in the thickness of plates used in the design of the boiler, which resulted in a net reduction in the weight of a boiler having about 29—30 sq. ft. of grate area, of 20 cwt. and a further reduction of 6 cwt. was obtained by using high tensile longitudinal and roof stays, a total decrease of 1 ton 6 cwt.

No difficulty was experienced in flanging this material, and no detriment could be discovered as the result of electric arc welding certain parts provided suitable electrodes were used. The practice of electric arc welding on boilers had not developed very far in England, although steady progress was being made. Up to the present no Chief Mechanical Engineer had had courage to weld all the seams on a locomotive boiler, although in America it was quite usual for the steel firebox plates to be welded and not riveted.

The future high speed locomotive would probably depart from the simple type originated by George Stephenson, in that it would be a super-steam-raising unit supplying high pressure steam to a small totally enclosed multi-cylinder high speed engine on the lines of the Doble or the Swiss Locomotive Company's engine which was tried a few years ago. One of the factors necessary for the success of such a machine would probably be a good water supply. On the L.M.S.R. in recent years an endeavour has been made to improve the quality of the water supplied to the locomotives. A large number of water softeners have been installed and are now being brought into service.

Having briefly reviewed some of the factors connected with locomotive design the next question was: "How does high speed affect railway working?" By careful design and suitable loading, the problem of high speed was not insurmountable, but combined with it was the problem of stopping distance. The L.M.S.R. was experimenting with an automatic signal of the Hudd type, *i.e.*, a magnet in the track operating an armature on the engine receiver unit which, through a relay, sounded a horn, and partly applied the brake. Whether any of these systems would help to speed up train working remained to be seen, but even with these devices functioning with the utmost reliability, the problem of the distance required for making a stop still remained.

An interesting additional series of slides was next shown consisting of diagrams and curves relating to brake experiments carried out on railways at home and abroad.

Coming to the question of streamlining, Mr. Stanier pointed out that a great deal had been heard about the advantages of streamlining, and undoubtedly against a head wind there must be a considerable saving in power if the locomotive and coaches were properly streamlined. Wind tunnel tests had shown this, and a paper was being read this session by Mr. Johansen before the Institution of Mechanical Engineers, giving some particulars of a research that was carried out for the L.N.E. and L.M.S. Railways. Streamlining might be something like that blessed word "Mesopotamia" to the old lady. At any rate, it had good publicity value. Slides illustrating various types of streamlined locomotives were then shown.

Anti-Friction Bearings

As regards bearings for locomotives and rolling stock, the President said that a great many countries were fitting roller bearings to carriage stock, and one or two locomotives had also been fitted as already mentioned, the L.M.S.R. Metropolitan - Vickers Lysholm turbine locomotive being the first in this country. It had been found on test that there was a reduction in the tractive effort required to start a train fitted with roller bearings, compared with one fitted with plain bearings, if the train was standing on a straight road, but it was difficult to measure any advantage when the train was standing on a curve or curves. The greatest advantage of the roller bearing seemed to be its greater capacity for taking end thrust without undue wear, so that the bearings did not readily become sloppy, and, therefore, one of the fruitful causes of a badly riding vehicle was avoided.

The address proper concluded with a brief review of possible future developments in the design and construction of steam locomotives. There was still much to be done and a wide margin to attack. The heat value of the fuel and the efficiency of the locomotive, as expressed by work done, still left something to be accomplished. There was ample evidence that the field for steam locomotives, particularly for long distance working and so far as this country was concerned, still had possibilities for further investigation. Improvements could not be made without a very close and detailed research which necessitated some form of testing which would enable results to be obtained much more readily than at present.

Research and the Future

Locomotive testing plants were under consideration and by the use of more complete means of measuring, improvement must follow. There was so much being done and so many keen brains were attacking the problem, that during the next few years something revolutionary might be evolved. It could safely be said that locomotive engineering was not standing still, and it was the duty of this institution to do all it could to assist in this regeneration.

The address was supplemented by fifteen appendices these covering the following subjects: (1) 4-8-0 high pressure triple expansion locomotive, Delaware & Hudson Railroad; (2) L.M.S.R. Metropolitan-Vickers Lysholm Turbine locomotive; (3) Baltimore & Ohio 4-6-4; (4) Northern Pacific 4-8-4 locomotive; (5) Northern Railway of France 2-8-2 tank locomotive; (6) new high powered articulated locomotive, Pittsburgh & West Virginian Railway; (7) express Beyer-Garratt locomotive; (8) Hiawatha streamlined 4-4-2 locomotive; (9) Pennsylvania 4-6-2 streamlined locomotive; (10) P.L.M. streamlined locomotive; (11) Canadian National 4-8-4 streamlined locomotive; (12) 4-4-4 streamlined locomotive C.P.R.; (13) German 4-6-4 streamlined locomotive; (14) Japanese streamlined locomotive, and (15) L.N.E.R. *Cock o' the North*. All of these were illustrated by slides during the address.

Sir Nigel Gresley, Chief Mechanical Engineer, L.N.E.R., proposing on behalf of the institution a hearty vote of thanks to Mr. Stanier for his address, expressed his pleasure at the mention of the late Mr. G. J. Churchward, whose pioneer work on the Great Western Railway in the introduction of such improvements as long-travel valves and larger steam passages had influenced to such an extent these components in the designs of the modern locomotives used by all of the four group railways in this country today. Mr. R. E. L. Maunsell, Chief Mechanical Engineer, S.R., seconded the vote, and Mr. Stanier briefly replied.

Proposed Renewal of Road Service A Licences

Opposition by railway companies to the Bouts - Tillotson application

At the Metropolitan Licensing Authority's Court at Romney House, Westminster, Mr. Gleeson Robinson, Traffic Commissioner for the Metropolitan Area and Licensing Authority for the London Traffic Area, continued on September 28 and 29 the hearing (adjourned on September 15) of the application by Bouts-Tillotson Transport Limited, London, for a renewal of its A licence in respect of 139 vehicles and 56 trailers. The case for the applicants was concluded in the course of September 15. The principal witness for the four opposing railway companies was Mr. Ashton Davies, Chief Commercial Manager, L.M.S.R., whose evidence was not concluded when the Court adjourned on September 15. He stated that between all large centres such as those concerned in the present objection the railway standard for merchandise conveyance was delivery on the day following despatch, and as far as possible on the morning of the day following despatch. The preponderance of deliveries were made before dinner-hour closing of consignees.

Railways a National Service

Mr. Ashton Davies, continuing his evidence on September 28, said that the services and facilities provided by the railway companies catered for the full requirements of all trades and industries. These services were available every day to anywhere and represented a national system of transport. The exigencies of the coal, iron, and steel trades were such that enormous peaks of traffic and unequal flows had constantly to be faced by the railways in the movement of traffic. Lack of balance in the flow of traffic over many routes imposed upon a common carrier service a considerable burden not shared by any form of transport without the statutory obligations of common carriers. As the railways were under statutory obligations the services they provided for one section of industry could not be regarded in isolation from the services provided for all other sections of industry. Apart from the question of applicants' vehicles being in excess, there were other important reasons why, in the public interest, the traffic carried in applicants' vehicles should not be so conveyed. The economics of railway transport demanded reasonably full occupation of the railway systems in order that the inevitably great burden of expenditure involved in the provision and maintenance of the railway systems might be spread over industry in its entirety with due regard to the ability of each section of industry to contribute to that expenditure.

Loss of Higher Class Traffic

For traffic between Newcastle and London there were 79 per cent. of deliveries on the day after despatch. Twenty-one per cent. of deliveries took place on the morning following, which was a better service than that afforded by road, which provided a two-day service. Replying to allegations of breakages of things carried by rail, Mr. Ashton Davies quoted one firm who sent 4,104 consignments in 1935, and made claims for breakages of only 21 of them. Tests taken during a normal week in 1935 showed that while Classes 1 to 6 represented 53·91 per cent. of the tonnage carried the receipts represented 27·08 per cent., whereas Classes 7 to 21 represented 46·09 per cent. of the tonnage but 72·92 per cent. of the receipts. A similar test taken in 1930 showed that the higher classes contributed 74·39 per cent. of the goods receipts and 46·45 per cent. of the tonnage. Comparing a period in 1935 with 1930, the average haul had increased in the case of mineral class (Classes 1 to 6) from 57·47 miles to 62·18 miles and in respect of general merchandise (Classes 7 to 21) from 93·00 to 101·87. Whilst the average receipt a ton for mineral class traffic reflected to some extent the increased haulage, the average receipts a ton for general merchandise had appreciably declined, which was attributable largely to the effect of road competition. This indicated that Classes 7 to 21 were ceasing to contribute their proper proportion to revenue, and the effect of that must be the possibility of an increase in other classes, or at least that they must remain at higher levels than would otherwise be necessary. The railways had been forced to grant a large number of exceptional rates in the higher classes to retain traffic. Road transport for long distances was preventing a reduction in the lower class rates which was desirable in the interests of trade and industry. Placing traffic on the roads which should go by rail meant either an increase in road facilities or blockage and congestion on the roads to the detriment of local users whose costs of distribution were inflated.

The Principle of Railway Charges

The railways claimed that they offered a service which was both adequate for and suitable to the current needs of industry in respect of the traffic carried by the vehicles of applicants and similar road operators. The railway services and facilities had been kept in step with the requirements of industry at great cost. The cause of traffic passing to the applicants' services was not primarily any deficiency in railway arrangements, but that the applicants were charging less than the railways would charge for the same consignments. Railway charges formed part of a scientific system of charging devised in the interests of trade and industry as a whole. The continuance of the ability of the applicants to carry meant the continuance of their ability to attract to themselves traffic which from the point of view of the sender could well be railway-borne at railway rates, and the attraction of such traffics, generally of the higher classes, was contrary to the public interest in that it tended to undermine the principle of classification and endangered the relatively low railway rates enjoyed by the lower classes of commodities, which was a matter of grave importance to the heavy industries and consequently the nation at large.

In cross-examination by Mr. E. S. Herbert, Mr. Ashton Davies said that the railways and their accompanying road services should have a monopoly of trunk services for traffic for which the railways could and did provide a suitable and efficient service. If all trunk services of road vehicles were removed by Christmas the railways would be in a position to carry the whole of that traffic. They were out to carry the business which the railways were designed to carry under a controlled monopoly which was in the widest interests of trade.

Alleged Delays

Mr. Ashton Davies was questioned about a number of complaints alleging delay, sometimes amounting to several days, in the delivery of goods from places in the Midlands and the North to Southampton. He undertook to look into them. Mr. Herbert also quoted from a considerable number of letters of complaint, and asked whether these instances explained the scepticism felt by traders as to railway deliveries being effected to places 200 miles away the day after despatch. Mr. Ashton Davies said he was not prepared to discuss the merits of any complaint made until it had been established that the complaint was well founded. His experience showed that in many instances the information submitted when complaints were made was not accurate and in most cases exaggerated.

The hearing was adjourned until Tuesday.

Mr. Ashton Davies, giving further evidence on Tuesday, September 29, said that attempts had been made to investigate complaints of delays on the railways. In some cases they had been unable to trace the particular consignment mentioned; in others there was reasonable explanation, such as public holidays, to account for the delay; and in others there was no substance generally. The inquiries were not completed until three o'clock that morning. Dealing with the investigations into a number of cases cited by a Southampton firm, Mr. Ashton Davies said that the whole of one day's traffic to this firm had been examined and it had been found that London traffic was delivered on the day following. The result of the investigation did not support the

general contention which was outlined in submitting the list. Having regard to what had transpired from the inquiries, he did not think they would be justified in investigating any more complaints unless the persons concerned were prepared to come and state their case in this court.

Mr. Gleeson Robinson said that there was a very long list indeed and it was alleged in some cases that delivery had taken twelve days. "You have not been able," he asked, "to deal with any of these cases and say whether they were delayed for these periods or not?"

Mr. Tylor (counsel for the railway companies) replied that they were presenting the result of the examination of particular instances from the list, and he suggested that other complaints should be substantiated by evidence.

Mr. Gleeson Robinson thought that in the public interest investigation should be made where there were complaints in order that the matter might be put right if possible.

Transhipment Cases

Mr. E. S. Herbert cross-examined Mr. Ashton Davies about the movements of Manchester-bound traffic from points in outer London, and asked whether, from many important points in the outer London belt—points at which many new factories had arisen—main line traffic to Manchester involved transhipment from one railway to another. Mr. Ashton Davies replied that certain traffic from places which were almost out of the fifteen miles radius—as distinct from the bulk of the traffic between London and Manchester—might take two days to get there.

Mr. Herbert asked for more information about a check of London to Manchester traffic on the L.M.S.R., which claimed to show that all traffic despatched on July 22 was delivered on July 23. He wished to know whether the traffic included that delivered by traders into the hands of the railway company on July 22 and also traffic handed to other railways that day.

Mr. Ashton Davies said that another witness would be called to answer these questions.

Shunting Precautions

Continuing his evidence, Mr. Ashton Davies said that last year the railway companies received £90,000 in half crowns paid by traders for the special green arrow service. They now had containers for bricks and for bicycles. They were always anxious to do all that was possible to avoid the re-handling of goods. In reply to a question from Mr. Gleeson Robinson as to whether there had been research into the use of containers which could be built up by sections, the witness said they had been considering that, but there were difficulties in dealing with the smaller container. Tests were being made with a new type of wagon to prevent the shock of shunting for goods which were fragile and needed care. Research into the loading of goods was being carried out.

Mr. E. A. Wilkinson, Secretary of Bouts-Tillotson Transport Limited, recalled, said that it had been found that the company had been operating at unremunerative rates and in October, 1935, all rates were revised. In 1935 there had not been a trading loss of £159,000, but of £28,000 odd. The cost of vehicles in the books had been drastically written down out of revenue, which had also borne substantial maintenance and replacement charges. The company was now running satisfactorily. For the past six months twenty of their vehicles were not in use, but they needed the full number asked for. It was a question of finance whether new vehicles would be bought or others hired.

Mr. Alec James Kelsall, Transport Manager of McClean's Limited, manufacturing chemists, said that when the bulk of his company's traffic was being borne by road two years ago the average transit time was three to four days, and one clerk was employed all his time answering complaints customers, averaging 14 a day. The bulk of the traffic was now rail-borne without any trouble at all. Complaints now averaged one every four days with double the turn-over.

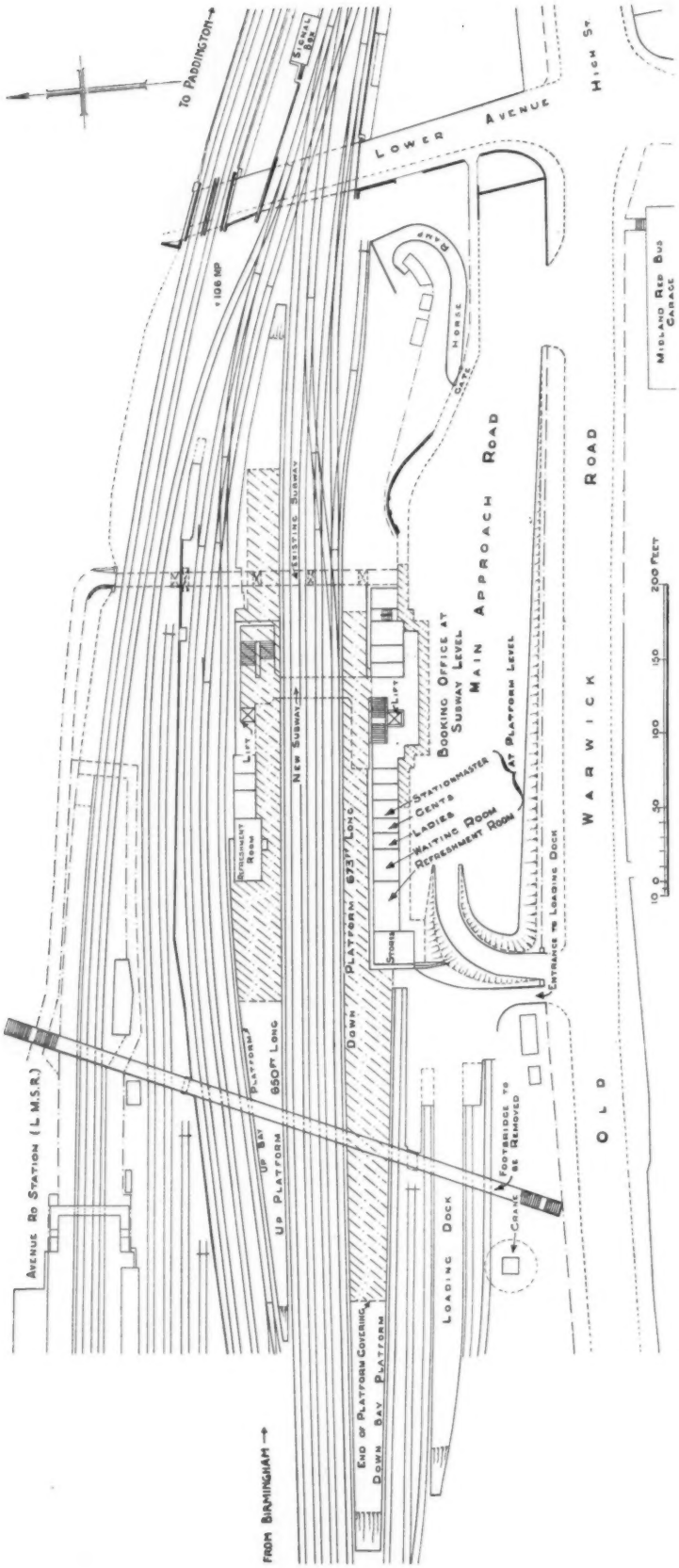
The hearing was adjourned until yesterday (Thursday).

The Silver Jubilee, L.N.E.R.

Wednesday last, September 30, was the first anniversary of the introduction by the L.N.E.R. of the Silver Jubilee service between King's Cross and Newcastle, which still remains the only fully streamlined steam-hauled train on British metals. Since the inauguration, the train has run daily, except on Saturdays and Sundays, and on certain days at Christmas, Easter, and Bank Holiday week ends; 498 journeys have been made, in all kinds of weather, during which arrivals from 1 to 5 min. before time have been made on 278 occasions, and in this connection it is remarkable that every arrival at King's Cross during the month of July was before time. As the non-stop schedule of 198 min. for the 232·3 miles between London and Darlington demands an average start-to-stop speed of 70·4 m.p.h., a total of 115,536 miles has been covered in the year by the one set of special vehicles (for there is no spare stock for this working) at an average speed of over 70 m.p.h. Taking the average speeds maintained by the train, it may be taken as certain that out of this total speed has exceeded 80 m.p.h. for fully 30,000 miles, and that no journey has been made without a maximum of 90 m.p.h. having been reached. Careful timings of the train have revealed that the speed has reached the 100 m.p.h. level on several occasions, culminating in the maximum of 113 m.p.h. recorded on August 27, when the dynamometer car was added to the usual load. It is notable that the punctuality record has been maintained notwithstanding the serious delay which applied for several months during the construction of a new underline bridge at New Barnet, which hampered the down run in particular. The locomotive work has been shared chiefly by the three locomotives, *Silver Link*, *Quicksilver*, and *Silver Fox*, the fourth —*Silver King*—being stationed as a reserve at Gateshead and used on other duties when not required for the Silver Jubilee workings. The total distance covered during the year has been 133,464 miles, and 68,000 passengers have been carried; on the large majority of its runs the train has been filled to capacity.

While no definite plans have as yet been prepared by the L.N.E.R. for additional high speed services of this description, the success of the Silver Jubilee has encouraged the making of various tests to explore the possibilities on other routes. One of these was carried out on Saturday last, September 26, when the train, with dynamometer car attached and engine No. 2511, *Silver King*, was run from Newcastle to Edinburgh and back, the 124·4 miles taking 118 min. northbound and 114 min. southbound. This, however, is considerably less than the normal speed of the Silver Jubilee south of York, and the northbound time of the test run was only 12 min. less than the present regular schedule of the 1.20 p.m. from King's Cross, which with a ten-coach load of 314 tons is allowed only 130 min. for the same distance. It is interesting, also, to recall that on the night of August 21, 1895, during the famous race to Aberdeen, the North Eastern Railway 4-4-0 No. 1620 of William Worsdell's design made the run from Newcastle to Edinburgh with a train of 101 tons in a time which has been fully authenticated as between 114 and 115 min.—a remarkable feat for the period. The test of last Saturday shows the practicability of a daily 6-hr. service between London and Edinburgh should circumstances make this desirable. Editorial comment on this matter appears on page 511 of this issue.

HUNAU-KWEICHOW RAILWAY CONSTRUCTION.—A Reuters message from Shanghai reports that work upon this 600-mile line has been begun. It will traverse difficult mountainous country entailing heavy tunnelling and bridging. It is understood that the alignment, as finally selected, will start from Chuchow —the future junction of the Chekiang-Kiangsi Railway with the Canton-Hankow line—and run to Kweiyang, the capital of Kweichow Province, and thence be extended into Yunnan beyond.



Plan showing Leamington Spa station, G.W.R., as it will be when the alterations described alongside have been carried out

Leamington Spa Station Alterations, G.W.R.

The main details were announced on Wednesday by the Great Western Railway of the extensive scheme of improvements for Leamington Spa station. The scheme provides for the complete rebuilding and enlargement of the existing station buildings; the provision of longer and wider platforms; and the arrangement of greatly improved facilities for the travelling public. All the buildings will be built in brick and steel, and in that facing Warwick Road, stone will also be used.

The two existing main and bay line platforms are to be rebuilt, raised to standard height above rail level, and considerably extended. The new up main line platform will be 650 ft. in length of which 360 ft. will be under cover. The down main line platform will be 23 ft. longer and will have 480 ft. under cover.

In place of the present high level and circular low level approach roads to the station, a spacious low level approach road, 70 to 80 ft. wide, is to be built between Warwick Road and the station. The lowering of the main approach road to the station will enable a new passenger and luggage subway 15 ft. wide to be built connecting the up and down platforms at road level. The existing subway giving access from the north to the south side of the station will remain.

A large booking hall with booking and parcels offices and other accommodation is to be provided at subway and road level. There will be waiting and refreshment rooms on both platforms and a cloak room, telegraph and stationmaster's offices, and various other offices on the down platform. In addition, a hostel for the Hotels & Refreshment Department staff is to be constructed above the station buildings on the down side.

The footbridge between Warwick Road and the L.M.S.R. station is to be taken down by arrangement with the Corporation. Opposite the existing main entrance a reinforced concrete horse ramp will be constructed, giving access from the approach road to the loading dock above Lower Avenue. A separate entrance to the loading docks at the west end of the station approach is to be provided.

Preliminary work on the scheme is expected to be begun within the next few weeks.

RUBBER-FACED RAILWAY BUFFER STOPS.—A Reuters message from Vienna states that rubber railway buffer stops which are claimed to possess many advantages over the usual steel buffers, have been built by a Czechoslovak engineer. By a new process he has been able to cover the metal buffers with a thick layer of a special type of rubber, which, he hopes, will reduce noise and also prolong the life of the rolling stock.

RAILWAY STAFF AND LABOUR MATTERS

Irish Railway Wages

The Irish Railway Wages problem is again in the news. The earnings of the staff in question have long been subject to a 10 per cent. deduction and the trade unions are once more seeking an increase in wages. On Friday last, September 25, a conference was held in Belfast between the representatives of the Great Northern Railway of Ireland and the London Midland and Scottish (Northern Counties Committee) with representatives of the railway trade unions. In an official announcement issued after the meeting it was stated: "The representatives of the companies intimated that in view of their present financial position they could not agree to any modification of the existing conditions regarding salaries and wages."

Mr. Ernest Bevin

The unanimous election of Mr. Ernest Bevin to the chairmanship of the general council of the Trades Union Congress, which was announced last week, is an event of more than passing interest. Mr. Bevin, who is well known as the General Secretary of the Transport and General Workers' Union, came into prominence at the time of the Court of Inquiry which followed the dockers' dispute in 1921. He took an active part in the formation in 1934 of the National Joint Conciliation Board for the Road Motor Transport Industry (Goods), and is a Vice-Chairman of that body. Mr. Bevin has the reputation of being a doughty fighter, but railway staff officers who have conducted labour negotiations with him know him also as a man whose word when given is honourably kept. His year of office seems likely to be a busy one.

Road Transport Wages

A case of exceptional importance concerning the wages and conditions of motor drivers in the road transport industry (goods) is dealt with in Industrial Court Decision No. 1,659, which has just been published. The Transport and General Workers' Union claimed that the wages paid to and the conditions of employment of persons employed by H. Tuckwell & Sons Ltd., Oxford, are not in accordance with Section 93 (1) of the Road Traffic Act, 1930, as extended by Section 32 (2) of the Road and Rail Traffic Act, 1933. The claim was based on the ground that the firm mentioned is paying lower rates than those fixed by the National Joint Conciliation Board for the Road Motor Transport Industry (Goods) for Grade 2 areas, which rates it had been decided by the East Midland Area Joint Conciliation Board were the rates payable in the City of Oxford for the drivers of vehicles carrying A and B licences.

It was admitted before the Court on behalf of H. Tuckwell & Sons Ltd. that the rates paid were lower than those laid down by the East Midland Area Joint Conciliation Board for the City of Oxford, namely, the rates for Grade 2 areas. These rates, it was stated, had never become operative, and the rates paid by the firm were those commonly paid by all other firms in the road haulage industry in the City of Oxford.

The Court states that "The issue in the present case is as to whether the firm concerned is or is not complying with the provisions of the Fair Wages Resolution, and for this purpose the Court has to determine as regards rates of wages, for example, what are the rates paid in the trade in the district concerned. It is no part of the duty of the Court to determine under the present reference what those rates should be. The rates having been determined, the question of whether the firm concerned is or is not paying them is merely one of comparison. The question as to how far a decision of a joint conciliation board as to rates of wages, &c., such as that to which the attention of the Court was directed in the present case, should be regarded as determining the rate of wages and conditions of employment proper to be observed in the localities which they purport to cover, is not a matter which comes within the scope of the present reference, and the decision of the Court in the present case is not to be regarded as being in any way indicative of the views of the Court in respect of this matter, which would appear to the Court to be one for consideration by the Committee on the Regulation of Wages in the Road Transport Industry recently appointed by the Ministers of Labour and Transport."

On September 22 the Court arrived at the conclusion that the firm in question was not acting in breach of the relevant Acts of Parliament. This case, which was rather in the nature of a test case, may have far-reaching results. It is worth noting that the Chairman of the Court for this hearing was Mr. John Forster, who is one of the three members of the Committee which is referred to in the above quotation and which (as recorded in our issue of July 24) has been appointed by the Ministers of Labour and Transport to examine and make recommendations with regard to the statutory regulation of wages and conditions of service of persons employed in the carriage of goods by road (whether in vehicles authorised under A, B, or C licences). This committee (the other members of which are Sir James Baillie, O.B.E., J.P., LL.D., Chairman, and Sir Gerald Bellhouse, C.B.E.) met on Tuesday last, September 29, at Montagu House, Whitehall, S.W.1, and, following submission of a written statement of evidence on behalf of the National Joint Conciliation Board for the Road Motor Transport Industry (Goods) in England and Wales, Mr. Bevin and Mr. Edwards, representing the board, were closely questioned concerning matters arising from their memorandum.

The board recommended that the Minister of Labour should be given powers to enforce, for a period of five years at least, the decisions of the board. Also, that the obligation to observe fair wages and conditions not less favourable than those laid down by the board should be imposed on the road transport industry (goods) as a whole, including C licence holders. When the evidence given on behalf of the National Joint Conciliation Board was concluded the committee adjourned, but is expected to sit again shortly. The four main-line railway companies, which have always had extensive activities in goods road haulage, are not parties to the National Joint Conciliation Board, but their employees are covered by national agreements of long standing with the N.U.R. and by a comprehensive machinery of negotiation.

Signalling on the Berlin "Nord-Süd"

The new North to South underground connection in Berlin, part of the "S" or Stadtbahn railway system belonging to the Reichsbahn, has been fitted with automatic signalling to permit of trains 460 ft. long running at 1½ min. intervals. The signals are light signals with internal spectacle mechanism, arranged to give the aspects standardised in 1935, namely: double-yellow for "stop, then proceed"; green-yellow for "caution"; and green-green for "clear"; the lights are displayed horizontally. Two green lights placed vertically indicate "proceed at reduced speed," and a red one "stop and stay." First and second inner homes are provided at each station, call-on and permissive signs being incorporated where necessary in controlled signals, in accordance with the German State Railway's latest practice. Motor driven train-stops, as already used with good results on the "Stadt" and "Ring" lines, are placed at all signals.

Three-position two-element a.c. track relays control the signal aspects, and the correct operation of the constituent elements of each block section is checked by proving circuits as the trains pass. Special arrangements have been made to ensure the continuity of the current supply in the event of failure of the ordinary mains supply. At the Stettin station, which is underground near the main line station of that name, a 40-lever electric power frame and track diagram have been provided, controlling four platform lines and two sidings, eight crossovers and the necessary signals.

NOTES AND NEWS

Electrical Industries Ball.—The annual Electrical Industries Ball will be held at Grosvenor House on Tuesday, November 24, under the presidency of Viscount Falmouth.

Moorgate Station, London Transport.—Work on the new interchange station at Moorgate reaches a further stage today (October 2) when the new escalators leading from the booking hall to the Northern City Line are to be brought into service.

New Station at Hersham.—A new station which the Southern Railway has built at Hersham, between Esher and Walton-on-Thames, was opened on September 28. Cheap day tickets from and to London are issued, as well as season and workmen's tickets.

Cheaper Fares via Harwich.—The L.N.E.R. announces that, because of the devaluation of the guilder, all fares to Holland and to Germany via Harwich have been reduced as from yesterday (October 1). Reductions in fares to other places on the Continent are being worked out by the staff.

Buenos Aires Passenger Transport Bill Passed.—The Bill for the co-ordination of all forms of passenger transport in the City of Buenos Aires was passed by the Argentine Senate on September 30—after an all-night sitting—by 16 votes to 6. The Bill was approved by the Chamber of Deputies on September 26, 1935. The terms of this Bill were outlined in the Overseas columns of our issue of March 8, 1935.

Tenders for New York Subway.—The New York Board of Transportation on September 4 rejected all bids received for the construction of the second section of the Sixth Avenue subway, between 33rd and 40th Streets, and advertised for new bids to be opened on October 2. Seven bids were in the rejected lot, as follow: J. F. Cogan Company, $6,492,626; Park Contracting Corp., $8,231,273; George H. Flinn Corp., $8,346,325; Arthur A. Johnson-Necaro Co. Inc., $9,601,014; Spencer, White & Prentis, Inc., $9,871,008; Carleton Co. Inc., $9,902,554; and Underpinning & Foundation Co. Inc., $10,498,443.

Proposed New Danube Bridge.—According to press reports from Belgrade, a new bridge over the Danube will be built between Turnu-Severin on the Roumanian side of the river and Kladovo, on the Jugoslav side. Jugoslavia will obtain from Roumania a large sum of money which will help in building a railway line on the Jugoslav side up to the bridge; difficulties in connection with this money are stated to have resulted in the postponement of work on the bridge until now. The bridge will cost 300,000,000 lei to build, of which each country will pay half. The work is expected to take about three years, and the bridge will carry a double railway track and special roads for motor traffic and pedestrians.

New American Bar at Charing Cross Hotel.—Yesterday (Thursday) the Southern Railway opened the new American Bar at the Charing Cross Hotel, which adjoins Charing Cross station. As this is the most centrally situated main-line station in London, from the point of view of overseas tourists, the new bar should prove a popular rendezvous.

Smokers for Women Only.—Smoking compartments for women only are now part of the equipment of the Canadian Pacific Railway. The new streamlined trains working between Toronto and Detroit, Montreal and Quebec, and Calgary and Edmonton all have these compartments. The innovation is "a bow to a long unanswered demand," an official explained to a Reuter correspondent.

Institution of Railway Signal Engineers' Dinner.—The sixteenth annual dinner of the Institution of Railway Signal Engineers will be held on Friday, October 23, at the Criterion Restaurant, Piccadilly Circus. The reception will be at 6.30 p.m., and dancing will follow dinner. Tickets, price 12s. 6d. each, may be obtained from Mr. M. G. Tweedie, Honorary Secretary of the Institution, 80, Caversham Road, Reading.

Stewarts and Lloyds New Issues.—Stewarts and Lloyds Limited is offering to holders of deferred stock and liaison deferred shares the whole of the unissued deferred shares of £1 each. They total 1,042,910, and will be offered at 26s. in the proportion of one for every £5 of stock held, each liaison deferred share ranking as equal to £1,000 of deferred stock. The new shares will be converted into stock and will rank *pari passu* with the existing deferred stock as from January 1, 1937. Further extensions now in progress at Corby works are designed to increase their iron and steel ingot capacity by 150,000 tons per annum, bringing it to about 600,000 tons per annum.

Success of the L.M.S.R. Bien Donne Restaurant in South Africa.—The success which has attended the L.M.S.R. Bien Donne Restaurant at the Empire Exhibition at Johannesburg is exemplified by reports which have been received by Sir Josiah Stamp, Chairman of the L.M.S.R., from Mr. Arthur Towle, Controller of the L.M.S. Hotel Services. A luncheon and afternoon party, given to the press on the day prior to the opening, was a great success, and on the opening day the Union Cabinet itself lunched in the restaurant and members of the Government expressed themselves as being delighted and highly appreciative of the L.M.S.R. Company's co-operation. The restaurant was fully booked for the opening gala dinner. Major Frye (Chairman of Executive Committee of the Exhibition) despatched the following cable to Sir Josiah Stamp: "The Bien Donne restaurant operating with striking success. I am sure that your company can hardly have done anything which will redound more to its credit."

Beama Annual Dinner, 1936.—The Lord Chief Justice (Lord Hewart) will be the guest of honour at the annual dinner of the British Electrical & Allied Manufacturers' Association, to be held at Grosvenor House, Park Lane, London, W.1, on Tuesday, November 17. Lord Derby, the President of the Association, will preside.

Welsh Autumn Sheep Sales.—The L.M.S.R. and G.W.R. will run special "sheep sales expresses" in connection with the sheep and lamb sales to be held at nearly 100 centres in Wales and in the Welsh Border counties this autumn. As many as 25,000 head of sheep, it is anticipated, will be put up for auction at one sale alone. Among the places concerned are Abergavenny, Bala, Brecon, Builth Wells, Caernarvon, Craven Arms, Dolgelley, Gloucester, Hereford, Llandovery, Llangollen, Ludlow, Shrewsbury, and Wellington. Railway representatives will be in attendance at the sales to give buyers information and assistance in connection with the transport of their purchases.

Northern Ireland Traffics.—Passenger receipts for the first six months of 1936 on railways wholly in Northern Ireland amounted to £115,715, against £107,243 for the first half of 1935, with an improvement from 2,286,596 to 2,372,792 in the number of passengers carried. Merchandise and mineral tonnage for the six months advanced from 279,364 tons to 329,582 tons, and the total receipts from goods traffic from £92,702 to £120,115. Railways partly in Northern Ireland carried 2,450,867 passengers (excluding season ticket holders) in the first six months of 1936, against 2,446,022 in the first half of 1935, and the passenger receipts improved from £182,385 to £189,149. The amount of merchandise and minerals carried was 485,547 tons, against 489,141 tons, and the total receipts from goods traffic increased from £302,674 to £319,966. The number of live stock carried advanced from 347,569 to 351,328.

Railway Development at Toronto Exhibition.—The story of Canadian railway development throughout a century was told in pictorial fashion at the Canadian National Exhibition at Toronto this year. The pioneer locomotive of Canada, the *Dorchester*, which made its first trip in 1836, was reproduced in full size, silhouetted against the locomotives of the twentieth century, including the new streamlined engines. On illuminated glass has been engraved a series of maps showing the growth of the Canadian National Railways system. A working model of The Continental Limited train was shown drawing into the station at Jasper National Park in

the Canadian Rockies, which was shown in relief, with motorcars connecting with Jasper Park Lodge, its famous holiday centre.

James Watt Statue for Glasgow Green.—A statue of James Watt is to be placed in Glasgow Green. At a recent meeting of the Glasgow Corporation Park Committee it was decided to accept an offer made by W. & J. Martin, leather merchants, Baltic Street, Bridgeton, of a statue of James Watt, which they have taken down from the doorway of their works to permit of an extension to their premises. The statue, which shows Watt standing beside a large cylinder, was designed by a sculptor named Grassby.

L.N.E.R. Scottish Area Best Kept Stations.—Awards in connection with the L.N.E.R. Best Kept Stations Competition in the Scottish Area have now been made and the following stations are the prize winners: Special Class—Helensburgh, Reedsmouth, and St. Monance; First Class—Bellingham (North Tyne), Bridge of Earn, Broughty Ferry, Burgh-by-Sands, Corstorphine, Drumburgh, Dundee (East), Grahamston, Hyndland, Kilpatrick, Kilsyth, Largo, Lennoxtown, Melrose, Newburgh, and Shandon. Twenty-five stations have also been awarded second class prizes, 44 stations have third class prizes, 61 have fourth class prizes, and 12 stations have received certificates of commendation.

Road Accidents.—The Ministry of Transport return for the week ended September 26 of persons killed or injured in road accidents is as follows. The figures in brackets are those for the corresponding period of last year :—

	Killed, including deaths resulting from previous accidents		Injured	
England ..	142	(124)	4,268	(3,958)
Wales	3	(6)	151	(189)
Scotland ..	11	(12)	425	(433)
	156	(142)	4,844	(4,580)

The total fatalities for the previous week were 130, compared with 155 for the corresponding period of last year.

British and Irish Traffic Returns

GREAT BRITAIN	Totals for 39th Week			Totals to Date		
	1936	1935	Inc. or Dec.	1936	1935	Inc. or Dec.
L.M.S.R. (6,916¼ mls.)	£	£	£	£	£	£
Passenger-train traffic...	533,000	496,000	+ 37,000	19,909,000	19,522,000	+ 387,000
Merchandise, &c. ...	497,000	476,000	+ 21,000	18,368,000	17,348,000	+1,020,000
Coal and coke ...	232,000	237,000	– 5,000	9,244,000	8,822,000	+ 422,000
Goods-train traffic ...	729,000	713,000	+ 16,000	27,612,000	26,170,000	+1,442,000
Total receipts	1,262,000	1,209,000	+ 53,000	47,521,000	45,692,000	+1,829,000
L.N.E.R. (6,332 mls.)						
Passenger-train traffic...	336,000	311,000	+ 25,000	12,934,000	12,704,000	+ 230,000
Merchandise, &c. ...	331,000	322,000	+ 9,000	12,449,000	11,972,000	+ 477,000
Coal and coke ...	241,000	241,000	—	8,939,000	8,509,000	+ 430,000
Goods-train traffic ...	572,000	563,000	+ 9,000	21,388,000	20,481,000	+ 907,000
Total receipts	908,000	874,000	+ 34,000	34,322,000	33,185,000	+1,137,000
G.W.R. (3,746½ mls.)						
Passenger-train traffic...	218,000	210,000	+ 8,000	8,414,000	8,316,000	+ 98,000
Merchandise, &c. ...	205,000	197,000	+ 8,000	7,340,000	7,036,000	+ 304,000
Coal and coke ...	97,000	100,000	– 3,000	3,876,000	3,802,000	+ 74,000
Goods-train traffic ...	302,000	297,000	+ 5,000	11,216,000	10,838,000	+ 378,000
Total receipts	520,000	507,000	+ 13,000	19,630,000	19,154,000	+ 476,000
S.R. (2,153 mls.)						
Passenger-train traffic...	310,000	298,000	+ 12,000	12,311,000	12,142,000	+ 169,000
Merchandise, &c. ...	71,000	67,500	+ 3,500	2,427,500	2,393,000	+ 34,500
Coal and coke ...	29,000	31,500	– 2,500	1,193,500	1,140,000	+ 53,500
Goods-train traffic ...	100,000	99,000	+ 1,000	3,621,000	3,533,000	+ 88,000
Total receipts	410,000	397,000	+ 13,000	15,932,000	15,675,000	+ 257,000
Liverpool Overhead ... (6½ mls.)	1,128	1,131	– 3	46,774	46,621	+ 153
Mersey (4½ mls.) ...	3,960	3,850	+ 110	156,754	155,247	+ 1,507
*London Passenger Transport Board ...	575,600	556,600	+ 19,000	7,234,900	7,012,800	+ 222,100
IRELAND						
Belfast & C.D. pass. (80 mls.)	2,586	2,325	+ 261	106,015	104,505	+ 1,510
,, ,, goods	466	540	– 74	20,790	19,426	+ 1,364
,, ,, total	3,052	2,865	+ 187	126,805	123,931	+ 2,874
†Great Northern pass. (543 mls.)	12,750	13,300	– 550	428,700	413,050	+ 15,650
,, ,, goods	9,450	10,600	– 1,150	361,200	354,650	+ 6,550
,, ,, total	22,200	23,900	– 1,700	789,900	767,700	+ 22,200
†Great Southern pass. (2,067 mls.)	39,511	38,933	+ 578	1,422,163	1,389,018	+ 33,145
,, ,, goods	45,304	43,304	+ 2,001	1,554,611	1,449,261	+ 105,350
,, ,, total	84,815	82,236	+ 2,579	2,976,774	2,838,279	+ 138,495

* 13th week. † 38th week.

British and Irish Railways Stocks and Shares

Stocks	Highest 1935	Lowest 1935	Prices Sept. 30, 1936	Prices Rise/Fall
G.W.R.				
Cons. Ord. ...	55½	44½	58	+½
5% Con. Prefce ...	124	108	123	—
5% Red.Pref.(1950)	117	106¾	109½	—
4% Deb.	118½	108	118	—
4½% Deb. ...	122	110	118½	—
4½% Deb. ...	129½	118	128	—
5% Deb.	140¼	130	137½	+1
2½% Deb. ...	82¼	68½	76	—
5% Rt. Charge ...	137	128	135½	—
5% Cons. Guar. ...	136¾	120½	133	—
L.M.S.R.				
Ord.	25 5/16	16	29	—
4% Prefce. (1923)	58¼	43½	78½	+½
4% Prefce. ...	87½	73½	88½	—
5% Red.Pref.(1955)	107	97¾	106½	—
4% Deb.	110¼	99½	110	—
5% Red.Deb.(1952)	119 11/16	111 5/16	116½	—
4% Guar. ...	105⅝	95½	105½	—
L.N.E.R.				
5% Pref. Ord. ...	15⅞	8¼	13¼	–¼
Def. Ord. ...	7 9/16	4¾	6¼	–¼
4% First Prefce.	74¾	48	76	–1
4% Second Prefce.	31¾	16¼	31	—
5% Red.Pref.(1955)	92¼	71	96½	—
4% First Guar. ...	103 11/16	93	102½	–½
4% Second Guar.	98¾	82½	98	—
3% Deb.	86	75	84	—
4% Deb.	109¼	98½	108	–½
5% Red.Deb.(1947)	118¼	106½	110½*	—
4½% Sinking Fund Red. Deb.	112½	108	109½	+½
SOUTHERN				
Pref. Ord. ...	87½	69¾	96	+3
Def. Ord. ...	25 3/16	16¾	24¾	+2¼
5% Prefce. ...	124	108¼	123	—
5% Red.Pref.(1964)	117¾	109½	116½	—
5% Guar. Prefce.	136½	121½	132	—
5% Red.Guar.Pref. (1957)	121¼	112½	117½	—
4% Deb.	116¾	107	116	—
5% Deb.	138	130¼	136½	+1
4% Red. Deb. 1962–67	115	106½	112½	—
BELFAST & C.D.				
Ord.	9	4	4½	—
FORTH BRIDGE				
4% Deb.	111¼	104¼	105½	+1
4% Guar. ...	109⅞	104	105½	+1
G. NORTHERN (IRELAND)				
Ord.	20	7	13¾	—
G. SOUTHERN (IRELAND)				
Ord.	57½	14½	58	—
Prefce.	50	25¼	62	–½
Guar.	88¾	51¼	91	—
Deb.	86¼	70	95	+¼
L.P.T.B.				
4½% "A" ...	130	119¾	126½	—
5% "A" ...	139¾	130	135½	+1
4½% "T.F.A." ...	113¾	108	110	—
5% "B" ...	131½	122¾	128½	—
"C"	109½	91	106	–1
MERSEY				
Ord.	23⅛	9¼	34	–1
4% Perp. Deb. ...	100½	93½	100	+1
3% Perp. Deb. ...	75½	67	76½	+1
3% Perp. Prefce.	62	47¼	66½	—

* ex dividend

CONTRACTS AND TENDERS

Guest Keen & Nettlefolds Limited has received an order from the Gaekwar's Baroda State Railway Administration for 161,000 steel sleepers to be supplied to the inspection of Messrs. Rendel, Palmer & Tritton.

Vivian Beyer-Garratt Locomotive Order

Beyer, Peacock & Co. Ltd. has received an order from Baddesley Collieries Limited for one Vivian type Beyer-Garratt locomotive. This is of the 0-4-0 + 0-4-0 type, having a tractive effort of 30,000 lb. on a 5 ft. 6 in. rigid wheelbase. The design was first purchased by the Vivian Copper Works, Swansea, and similar engines are now working at Guest Keen Baldwins, Cardiff, and Sneyd Collieries. On the closing of the copper works at Swansea the I.C.I. has transferred the original Vivian locomotive to Billington where it is now working.

S.A. des Acieries de Famille-ureux has received an order from the Eagle Oil & Shipping Co. Ltd. for thirteen 35-ton tank wagons for the conveyance of fuel oil, and five 34-ton wagons for the conveyance of petrol, complete with wheels and axles and both vacuum and hand brakes, for service on the San Paulo Railway.

Alex. Findlay & Co. Ltd. has received an order from the Central Argentine Railway for a chromodor steel plate girder, double track, through span bridge of 25 m. clear span.

W. T. Henley's Telegraph Works Co. Ltd. has received an order from the Indian Stores Department for 24,000 ft. of 660 volt, 6 core railway signalling cable at a total price of Rs. 13,980 c.i.f. Karachi.

R. Wright & Partners Limited has received orders from the Indian Stores Department for quantities of galvanised iron wire at a total price of Rs. 23,470, free delivery N.W.R. Stores Depot, Karachi.

Stewarts and Lloyds Limited has received rate contracts from the Indian Stores Department for the supply of galvanised and ungalvanised mild-steel pipes.

Sulzer Bros. Ltd. has received an order from the Indian Stores Department for one oil-engine driven 750 kVa 11,000 volt alternator set at a total price of Rs. 146,247 f.o.r. Dehra Dun.

Alfred Herbert Limited has received an order for one No. 4 capstan lathe and one type O drilling machine from the Midland Uruguay Railway.

Leyland Motors Limited has received the following orders from railway and railway-associated road transport operators: South African Railways & Harbours Administration, a number of Hippos and Tigers; New South Wales Dept. of Road Transport, one Titan vehicle; and Lincolnshire Road Car Co. Ltd., thirty oil-engined Cubs.

Guest, Keen, Williams Limited has received a running contract from the Indian Stores Department for the supply of electrodes.

A.C.E.C. (India) Limited has received an order from the Indian Stores Department for a total of 4,800 yards of paper-insulated cable at a total price of Rs. 24,142 free delivery.

La Brugeoise et Nicaise et Delcuve has received orders from the Peruvian Corporation for three 30-ton and 10 35-ton all-steel bogie covered goods wagons.

The Chinese Government Purchasing Commission has placed orders to the inspection of Messrs. Fox & Mayo with the English Steel Corporation for locomotive couplers, draft gear and locking blocks and with Bullers Limited for telephone materials. This equipment is required for the Canton-Hankow Railway.

The Bengal & North Western Railway Administration has placed orders for two locomotive boilers to be supplied to the inspection of Messrs. Rendel, Palmer & Tritton as follow: Nasmyth Wilson & Co. Ltd., one boiler for YB class locomotive; and the Yorkshire Engine Co. Ltd., one boiler for YF class locomotive.

The Bengal-Nagpur Railway Administration has placed the following orders:—

Jas. McIlwraith & Co. Ltd., Waterproof and tarpaulin canvas.
Guest, Keen, Williams Limited, 1,000 cwt. m.s. bolts and 970 cwt. m.s. nuts.
P. C. Dutta & Sons, 250 cwt. m.s. nuts, to be manufactured by Walker & Wilson.
Geo. Spencer, Moulton & Co. (India) Ltd., 8,000 vacuum cylinder rolling rings.
Heatly & Gresham Limited, 2,350 brake release valves to be manufactured by Gresham & Craven (India) Limited.

Motor Rail Limited has received an order from the South Indian Railway to the inspection of Messrs. Robert White & Partners, for the conversion of two petrol-driven railcars to diesel operation. One car is to have a Gardner four-cylinder 40-b.h.p. diesel engine with three-speed gearbox and transmission to be supplied by David Brown & Sons, and the other will have a Dorman-Ricardo four-cylinder 65-b.h.p. engine.

The Indian Stores Department, Miscellaneous Section, has placed running contracts for the supply of steel required for the State Railways with the United Steel Cos. (India) Ltd.; Guest, Keen, Williams Limited; B. Odhavji & Co.; Richardson & Cruddas; Balmer, Lawrie & Co. Ltd.; Burn & Co. Ltd.; and Krupp Indian Trading Co. Ltd. Running contracts for tool steel have been placed with Samuel Osborn (India) Limited; Vickers (India) Limited; Jessop & Co. Ltd.; John King & Co. Ltd.; Asbestos & Belting Co. Ltd.; and William Jacks & Co. Ltd.

The South Indian Railway Administration has placed the following orders to the inspection of Messrs. Robert White & Partners:—

Guest Keen & Nettlefolds Limited, 24 tons of steel cotters.
Barrow Haematite Iron & Steel Co. Ltd., 167 tons of 60-lb. B.S.S. rails and 19 tons of fishplates.
Banting & Tresillian, 2,000 mild steel boiler tubes.
Thomas Firth & John Brown Limited, 400 helical springs.

The Chief Controller of Stores, Indian Stores Department (Engineering Section), Simla, invites tenders receivable by October 22 for a total of 800 laminated bearing springs.

The Assam-Bengal Railway Administration invites tenders, receivable by October 8, at 56, Victoria Street, S.W.1, for 600 carriage and wagon tyres.

The Bengal & North Western Railway Administration invites tenders, receivable by October 20 at 237, Gresham House, Old Broad Street, London, E.C.2, for two locomotive boilers required for old B class superheated locomotives.

The Indian Stores Department is calling for tenders (Order No. E. 500) for the supply and delivery of double cotton covered, single cotton covered and double silk covered copper wire, for winding purposes, as and when required during the year beginning March 1, 1937. Tenders should be addressed to the Indian Stores Department, Electrical Section, New Delhi, where they will be received until November 3.

The Chief Controller of Stores, Indian Stores Department (Miscellaneous Section), Simla, invites tenders receivable by October 26 for the supply of dry pigments, paints, bituminous solution, crude tar, enamels and varnishes during the period March 1, 1937, to February 28, 1938; receivable by October 31 for oils and greases; receivable by November 2 for petrol, kerosene, mineral cleaning and gas making oils and tallow; and receivable by November 6 for coconut oil.

The South African Railways & Harbours Administration is calling for tenders (Tender No. 1039) for the supply and delivery of two grabs for handling manganese ore. Tenders, receivable by November 4 and endorsed "Tender No. 1039 for Grabs," should be addressed to the Chief Stores Superintendent, Park Station Chambers, Johannesburg.

Forthcoming Events

Oct. 1–31.—National Smoke Abatement Society Exhibition, at Science Museum, South Kensington, London, S.W.7.

Oct. 6 (*Tues.*).—Hull Traffic Association, at Chamber of Commerce, 7.30 p.m. "What are the Elements to be Considered in Co-ordination of Transport," by Mr. M. Barnard.

L.N.E.R. (York) Lecture and Debating Society, at Co-operative Hall, Railway Street, 6.45 p.m. "Palestine and its Problems," by Mr. C. M. Jenkin Jones.

Oct. 8 (*Thurs.*).—Railway Club, at Royal Scottish Corporation Hall, Fetter Lane, London, E.C.4, 7.30 p.m. "Some British Railway Accidents," by Mr. H. W. Bardsley.

OFFICIAL NOTICES

The Bengal & North Western Railway Company Limited

THE Directors are prepared to receive Tenders for the supply of:—
TWO LOCOMOTIVE BOILERS—OLD "B" CLASS SUPERHEATED,
as per Specification to be seen at the Company's Offices.

Tenders addressed to the undersigned, and envelope marked "Tender for Boilers," with name of firm tendering, to be lodged not later than Noon on the 20th day of October, 1936.

For each Specification a fee of 10s. will be charged, which cannot under any circumstances be returned.

The Directors do not bind themselves to accept the lowest or any Tender.

By Order of the Board,
W. R. IZAT,
Managing Director.

237, Gresham House,
Old Broad Street,
London, E.C.2.
24th September, 1936.

South Indian Railway Company Limited

THE Directors are prepared to receive Tenders for the supply of:—

1. Anti-corrosive Paint.
2. Steel Tyres.
3. Rolled Steel Disc Wheels and Axles.

Specifications and Forms of Tender will be available at the Company's Offices, 91, Petty France, Westminster, S.W.1.

Tenders addressed to the Chairman and Directors of the South Indian Railway Company, Limited, marked "Tender for Anti-corrosive Paint," or as the case may be, with the name of the firm tendering, must be left with the undersigned not later than 12 noon on Friday, the 9th October, 1936, in respect of Specification No. 1, and not later than 12 noon on Friday, the 16th October, 1936, in respect of Specifications Nos. 2 and 3.

A charge, which will not be returned, will be made of 5s. for each copy of Specifications Nos. 1 and 2 and of 10s. for each copy of Specification No. 3.

Copies of the drawings may be obtained at the Offices of the Company's Consulting Engineers, Messrs. Robert White & Partners, 3, Victoria Street, Westminster, S.W.1.

E. A. S. BELL,
Managing Director.

91, Petty France,
Westminster, S.W.1.
30th September, 1936.

TEST ROOM ASSISTANTS.—Railway Signal relay testers and adjusters wanted for Wembley factory. Consideration will be given to improvers having suitable bench experience. State age, qualifications, and wages required.—Box No. 22, c/o THE RAILWAY GAZETTE, 33, Tothill Street, S.W.1.

RAILWAY AND OTHER REPORTS

Barsi Light Railway.—Net earnings for the year to March 31, 1936, less Indian income tax and super tax, amounted to £54,030, or, adding exchange adjustments of £274, £54,304. As already announced, the total distribution on the ordinary stock for the year is to be 4½ per cent., against 5 per cent. for the previous year, leaving £8,415 to be carried forward. As against the previous year there is an increase of 78,943 in the number of passengers and of Rs. 1,15,103 in coaching traffic and sundry receipts. Goods traffic shows an increase of Rs. 778 and 989 tons. Working expenses at Rs. 11,34,730 are only Rs. 480 higher than last year, and owing to the increase in earnings represent 58·91 per cent. on the gross earnings, as against 62·65 per cent. in the previous year. The directors regret that they are unable to recommend the payment of a larger dividend, having regard to the necessity of conserving the company's resources in view of the unfavourable prospects of the current year caused by an outbreak of plague and by the failure of the monsoon.

San Paulo (Brazilian) Railway.—An interim dividend on account of the year 1936 of 2 per cent. free of tax on the ordinary stock is announced; warrants will be posted on October 22. No interim dividend was paid on the ordinary stock for 1935, but a payment of 2½ per cent., free of tax, was declared for the year at the general meeting.

Stothert & Pitt Limited.—The directors recommend a dividend on the ordinary shares for the year ended June 30 of 7½ per cent.; the reserve is to be increased by £20,000. No distribution on the ordinary shares was made for the previous four years.

Stewarts and Lloyds Limited.—Interim dividends have been declared for the half year to June 30 at 6 per cent. per annum on the cumulative first preference, at 10 per cent. per annum on the cumulative second preference, and at 5 per cent. per annum on the cumulative third preference, all payable, less tax, on October 31.

London Inter-Station Bus Services

Yesterday, October 1, the main-line railway companies, in co-operation with the London Passenger Transport Board, introduced a new service of non-stop buses across London linking the railway termini at King's Cross (L.N.E.R.), St. Pancras and Euston (L.M.S.R.), Marylebone (L.N.E.R.), and Paddington (G.W.R.), with Victoria and Waterloo (Southern Railway). For some years past bus connections between the chief north and south termini have been maintained for through passengers by the main-line railways with coaches supplied by a contractor; the new services replace these.

As will be seen from the accompanying illustration, a specially-designed body, in distinctive blue livery, has been adopted by the London Passenger Transport Board for the vehicles with which it is maintaining the services. It is a 20-seat vehicle, and the chief feature is that the rear seats are on a higher level than the front. This enables a locker (entered by exterior rear doors) to be provided over the back axle under the higher-level seats, accommodating 15 cwt. of luggage. The chassis adopted is the petrol-engined Leyland Cub, the type classified as C in the L.P.T.B. fleet.

Services with these buses have been arranged to connect with the arrival and departure of the chief main-line expresses and boat trains. Passengers not holding through tickets are charged 1s. for adults and 6d. for children between any two of the stations served.

Railway Share Market

Sentiment in the stock and share markets has been influenced favourably by the devaluation of the franc and the measure of agreement between Britain, France and the United States to prevent any disorganisation of the foreign exchanges.

Demand for the preferred and deferred stocks of the Southern Railway provided the chief feature of interest among home railway stocks, and they have been strong up to 96 and 24¾ respectively. The gain of £13,000 in the railway's traffics for the past week was in accordance with expectations and it is assumed that before long the receipts will begin to benefit from an increased number of visitors to the Continent owing to the lower level of the French and Swiss currencies. The Great Western also reported a traffic gain of £13,000 for the past week. This was rather below anticipations, but the hope of gradual improvement in the South Wales coal trade induced further buying of the railway's ordinary stock which showed a good deal of activity around 58. L.M.S. stocks were steady, particularly on Wednesday after the announcement of the past week's traffic increase of £53,000. The ordinary stock, which is around 29, is now generally expected to receive a payment of 1 per cent. for the current year, granted that traffic figures continue to be of a satisfactory character. L.N.E. issues were steady, particularly the second preference at around 31. For the past week the railway reports an increase of £34,000 in receipts. London Transport "C" stock was fractionally lower. French railway sterling bonds made further good recovery.

Foreign railway stocks showed general improvement. Interest again centred largely on those of the Argentine railways, mainly owing to the belief that the outlook is improving. There is a growing disposition to assume that the trend in the price of wheat will be upward and that before long improvement in the Argentine exchange is likely to be such as to permit of the railways remitting money from the Argentine on a much more favourable basis than for some time. Moreover, it appears that much better relations exist with the Argentine Government. The prior charges were particularly favoured and in most cases gains of several points have been established. B.A. Great Southern and Central Argentine issues were perhaps outstanding, but the improvement was general. Best prices were not, however, maintained as profit taking was in evidence later, especially in the ordinary stocks.

San Paulo rose strongly to 77 following the announcement of the resumption of interim dividends with a payment of 2 per cent., which had not been generally expected in the market. Leopoldina and Antofagasta were higher, but Nitrate Rails reacted moderately. Canadian Pacific issues were rather uncertain and American railroad stocks failed to hold earlier gains.

Traffic Table of Overseas and Foreign Railways Publishing Weekly Returns

	Railways	Miles open 1935-36	Week Ending	Traffics for Week: Total this year	Traffics for Week: Inc. or Dec. compared with 1935	No. of Weeks	Aggregate Traffics to Date: Totals: This Year	Aggregate Traffics to Date: Totals: Last Year	Aggregate Traffics to Date: Increase or Decrease	Shares or Stock	Prices: Highest 1935	Prices: Lowest 1935	Prices: Sept. 30, 1936	Prices: Yield (See Note)
				£	£		£	£	£					
South & Central America.	Antofagasta (Chili) & Bolivia	834	27.9.36	14,810	+ 1,87	39	525,700	475,870	+ 49,830	Ord. Stk.	23	14 15/16	19	Nil
	Argentine North Eastern	753	26.9.36	9,835	+ 352	13	120,186	110,078	+ 10,108	,,	7	4	4	Nil
	Argentine Transandine	—	—	—	—	—	—	—	—	A. Deb.	49 1/2	30	47 1/2	8 7/16
	Bolivar	174	Aug., 1936	4,900	— 700	35	52,500	50,300	+ 2,200	6 p.c. Deb.	13	5	7 1/2	Nil
	Brazil	—	—	—	—	—	—	—	—	Bonds.	14	11	15 1/2	3 1/4
	Buenos Ayres & Pacific	2,806	26.9.36	76,471	+ 2,484	13	942,634	934,883	+ 7,751	Ord. Stk.	101 1/2	47/8	19	Nil
	Buenos Ayres Central	190	19.9.36	$150,700	+ $11,600	12	$1,568,300	$1,516,400	+ $51,900	Mt. Deb.	21	10	13 1/2	Nil
	Buenos Ayres Gt. Southern	5,084	26.9.36	108,706	— 20,537	13	1,388,902	1,556,658	— 167,756	Ord. Stk.	27	13 1/2	21	Nil
	Buenos Ayres Western	1,930	26.9.36	39,059	— 2,397	13	498,996	521,243	— 22,247	,,	24	10	17 1/2	Nil
	Central Argentine	3,700	26.9.36	146,829	+ 29,169	13	1,739,359	1,542,177	+ 197,182	,,	17 7/8	7	15 1/2	Nil
	Do.	—	—	—	—	—	—	—	—	Dfd.	9	3 1/4	8	Nil
	Cent. Uruguay of M. Video	273	19.9.36	12,560	+ 4,323	12	124,857	100,075	+ 24,782	Ord. Stk.	8 1/2	3	4	Nil
	Do. Eastern Extn.	311	19.9.36	2,034	+ 426	12	20,549	16,872	+ 3,677	—	—	—	—	—
	Do. Northern Extn.	185	19.9.36	1,498	+ 359	12	17,511	13,156	+ 4,355	—	—	—	—	—
	Do. Western Extn.	211	19.9.36	316	+ 306	12	11,281	8,934	+ 2,347	—	—	—	—	—
	Cordoba Central	1,218	26.9.36	28,350	+ 110	13	455,610	421,230	+ 34,380	Ord. Inc.	4	1	2	Nil
	Costa Rica	188	July, 1936	21,438	+ 7,708	4	21,438	13,730	+ 7,708	Stk.	35	30	34	6
	Dorada	70	July, 1936	16,000	+ 2,400	31	95,300	80,400	+ 14,900	1 Mt. Db.	103 5/8	102 1/2	104 1/2	5 1/4
	Entre Rios	810	26.9.36	13,747	+ 970	13	160,026	159,653	+ 373	Ord. Stk.	15	6 1/2	10 1/2	Nil
	Great Western of Brazil	1,082	26.9.36	6,600	— 800	39	282,800	280,900	+ 1,900	Ord. Sh.	1/2	5/16	3/4	Nil
	International of Cl. Amer.	794	July, 1936	$310,697	— $17,787	31	$3,307,311	$2,960,670	+ $346,641	—	—	—	—	—
	Interoceanic of Mexico	—	—	—	—	—	—	—	—	1s. Pref.	1/2	5/32	1/2	Nil
	La Guaira & Caracas	22¾	Aug., 1936	4,945	+ 1,090	35	37,195	31,425	+ 5,770	,, k.	8 1/2	8	5 1/2	Nil
	Leopoldina	1,918	26.9.36	24,838	+ 3,305	39	733,688	671,203	+ 62,485	Ord. Stk.	8 1/2	2 1/2	9	Nil
	Mexican	483	21.9.36	$235,700	+ $26,800	12	$2,940,600	$2,950,100	— $9,500	,,	1 1/2	1/4	1/2	Nil
	Midland of Uruguay	319	Aug., 1936	7,887	+ 2,378	9	15,621	11,011	+ 4,610	,,	1 1/2	1 1/2	1/2	Nil
	Nitrate	397	15.9.36	3,724	— 1,112	37	89,845	105,970	— 16,125	Ord. Sh.	64/-	42/-	29/-	Nil
	Paraguay Central	274	26.9.36	§2,387,000	+ §116,900	13	§33,466,000	§29,128,000	+ §4,338,000	Pr. Li. Stk.	80 1/2	60	72 1/2	3 1/2
	Peruvian Corporation	1,059	Aug., 1936	87,240	+ 12,556	9	171,561	148,497	+ 23,064	Pref.	10 5/8	6 7/16	11	Nil
	Salvador	100	19.9.36	17,989	— §4,961	12	§124,115	§142,361	— §18,246	Pr. Li. Db.	65	61	15	Nil
	San Paulo	153¼	20.9.36	26,017	— 5,144	38	1,131,922	918,642	+ 213,280	Ord. Stk.	80	35	77	3 1/4
	Taltal	164	Aug., 1936	3,625	+ 1,205	9	6,150	4,945	+ 1,205	Ord. Sh.	1 11/16	1 1/8	7/8	12 5/16
	United of Havana	1,353	26.9.36	15,637	+ 2,589	13	201,825	222,103	— 20,278	Ord. Stk.	3 1/16	1	2 1/2	Nil
	Uruguay Northern	73	Aug., 1936	778	+ 213	9	1,644	1,199	+ 455	Deb. Stk.	4 1/2	2 15/16	4 1/2	Nil
Canada.	Canadian National	23,615	21.9.36	847,213	+ 66,140	38	25,706,394	23,996,830	+ 1,709,564	—	—	—	—	—
	Canadian Northern	—	—	—	—	—	—	—	— 4 p.c.	Perp. Dbs.	78 3/8	52 1/2	68 1/2	5 15/16
	Grand Trunk	—	—	—	—	—	—	—	—	4 p.c. Gar.	103 5/8	93	101 1/2	3 15/16
	Canadian Pacific	17,220	21.9.36	653,400	+ 8,400	38	19,054,600	17,445,800	+ 1,608,800	Ord. Stk.	14 1/16	8 5/8	12 1/2	Nil
India.†	Assam Bengal	1,329	10.9.36	33,097	+ 2,179	23	537,914	518,020	+ 19,894	Ord. Stk.	92 1/8	77 1/2	85 1/2	3 1/2
	Barsi Light	202	31.8.36	3,247	+ 225	21	53,760	62,625	— 8,865	Ord. Sh.	105	77 1/2	69 1/2§	7 5/16
	Bengal & North Western	2,112	10.9.36	59,253	+ 7,795	23	1,203,572	1,112,977	+ 90,595	Ord. Stk.	30 11/2	29 1/4	31 0	5 5/16
	Bengal Dooars & Extension	161	10.9.36	3,925	+ 166	23	55,978	56,489	— 511	,,	12 7/2	12 2	12 5/2	5 9/16
	Bengal-Nagpur	3,268	10.9.36	135,525	— 14,640	23	2,672,685	2,823,730	— 151,045	,,	105	100 5/16	102 1/2	3 7/8
	Bombay, Baroda & Cl. India	3,072	20.9.36	191,700	— 4,350	25	3,833,700	3,604,800	+ 228,900	,,	11 5/4	110	11 2/2	5 5/16
	Madras & Southern Mahratta	3,229	10.9.36	125,475	+ 1,332	23	2,491,213	2,427,187	+ 64,026	,,	12 8/2	11 3/8	11 2/2	8
	Rohilkund & Kumaon	546	10.9.36	9,802	+ 990	23	237,018	211,487	+ 25,531	,,	294	262	30 8/2	5 5/16
	South Indian	2,532	10.9.36	114,314	+ 9,687	23	1,810,321	1,819,580	— 9,259	,,	119 3/4	104 1/4	103 1/2	5 5/16
Various.	Beira-Umtali	204	July, 1936	67,976	+ 3,936	44	645,318	640,305	+ 5,013	—	—	—	—	—
	Bilbao River & Cantabrian	15	Aug., 1936	1,791	+ 628	35	11,993	12,197	— 204	—	—	—	—	—
	Egyptian Delta	620	10.9.36	6,860	+ 736	23	95,329	88,869	+ 6,460	Prf. Sh.	2	15/8	1 3/4	5 11/16
	Great Southern of Spain	104	29.8.36	568	- 2,514	35	33,623	62,623	— 28,994	Inc. Deb.	3 1/2	2	3 1/2	Nil
	Kenya & Uganda	1,625	Aug., 1936	165,963	— 1,758	34	1,781,864	1,641,345	+ 140,519	—	—	—	—	—
	Manila	—	—	—	—	—	—	—	—	B. Deb.	48	36	43	3 1/8
	Mashonaland	913	July, 1936	103,104	— 8,610	44	1,019,185	1,159,674	— 140,489	1 Mg. Db.	104 1/4	100	103 1/2	4 13/16
	Midland of W. Australia	277	July, 1936	10,214	— 794	4	10,214	11,008	— 794	Inc. Deb.	98 3/4	93	95 1/2	4 5/16
	Nigerian	1,905	15.8.36	27,910	+ 10,630	20	565,554	472,374	+ 93,180	—	—	—	—	—
	Rhodesia	1,538	July, 1936	199,545	+ 401	44	1,868,330	1,923,854	— 55,524	4 p.c. Db.	105 1/2	101	106	3 3/4
	South African	13,263	5.9.36	632,428	+ 45,641	22	13,503,532	12,364,453	+ 1,139,079	—	—	—	—	—
	Victoria	4,728	June, 1936	703,693	+ 16,855	52	9,689,925	9,421,092	+ 268,833	—	—	—	—	—
	Zafra & Huelva	112	May, 1936	8,821	— 2,027	22	48,574	55,398	— 6,823	—	—	—	—	—

NOTE.—Yields are based on the approximate current prices and are within a fraction of 1/16.

† Receipts are calculated @ 1s. 6d. to the rupee. § ex dividend. Salvador and Paraguay Central receipts are in currency.

The variation in Sterling value of the Argentine paper peso has lately been so great that the method of converting the Sterling weekly receipts at the par rate of exchange has proved misleading, the amount being overestimated. The statements from July 1 onwards are based on the current rates of exchange and not on the par value.

Diesel Railway Traction

Diesel Traction in the British Isles

THE application of oil engines to railway traction in Britain began, appropriately enough, with something which was only half-way to a diesel engine, namely, the Kitson-Still locomotive, in which steam was used at starting and at periods of heavy load, full oil working being attained only at speed. Shortly afterwards, the Beardmore-engined train appeared for a brief period on the lines of the L.M.S.R., but considering that these two efforts were made between ten and a dozen years ago the development of oil-engined traction on the railways of this country has not been particularly rapid, and there are only between 70 and 80 vehicles at work, although there are in addition numerous small-power diesel locomotives in use at works and for contractor's purposes.

L.M.S.R. Applications

The L.M.S.R. has the largest number of diesel vehicles, the total of 35 being made up of 22 oil-electric, 9 diesel-mechanical, and one diesel-hydraulic shunting locomotives, and the three Leyland diesel-hydraulic railcars. Of the locomotives with electric transmission, 10 are 350 b.h.p. Armstrong-Whitworth units, and one is a 250 b.h.p. machine by the same maker; the remaining 11 are 350 b.h.p. 50-ton locomotives built by the English Electric Co. Ltd. The locomotives with geared drive comprise four built by the Hunslet Engine Co. Ltd. (with M.A.N., McLaren-Benz, Brotherhood-Ricardo, and Paxman engines respectively); two by Hudswell, Clarke & Co. Ltd. (with Mirrlees engines); one by the Drewry Car Co. Ltd. (with an Allen engine); one by Harland & Wolff Limited (with a Harland-B. & W. two-stroke engine); and a small 70 b.h.p. locomotive built by John Fowler & Co. (Leeds) Ltd. The Leyland railcars were set to work early in 1934. One of them now is operating in the Airdrie district and two on the Blackburn-Clitheroe branch. Originally they were powered by 130 b.h.p. engines, but now have the maker's standard 90-95 b.h.p. engine as fitted to numerous road vehicles. Additional to the vehicles enumerated above, a three-car diesel train with Leyland engines and partial-hydraulic transmission is being built at the L.M.S.R. works at Derby.

Other Vehicles in England

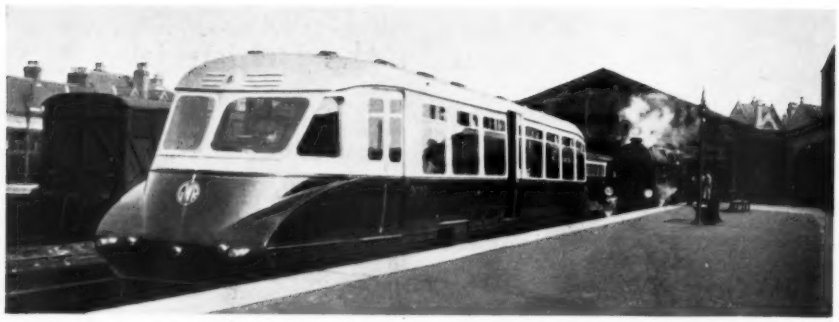
Next in order comes the Great Western Railway, with a total of 20 vehicles, made up of 18 A.E.C. railcars and two locomotives. The railcars and the services (totalling over 3,600 miles a day) which they operate are described elsewhere in this issue. Of the two locomotives one is a 70 b.h.p. four-wheeled Fowler unit with mechanical transmission, and the other a 350 b.h.p. English Electric unit with electric transmission and practically the same as the eleven locomotives at work on the L.M.S.R. On the L.N.E.R., diesel working is confined to railcars, of which there are four—three being the heavy double-bogie cars of 250 b.h.p. built in 1931-32 by Armstrong-Whitworth, and named *Tyneside, Venturer, Northumbrian,* and *Lady Hamilton,* and the fourth the 95 b.h.p. oil-electric double-bogie car with an Armstrong-Saurer engine. The three big cars work normally in the Leeds, York, Harrogate, Hull, and Selby area. At the moment of writing, the Southern Railway has no diesel vehicles in operation, a state which must be due in part to the extensive electrification. However, a number of diesel-electric shunting locomotives are being built at Eastleigh, the power and transmission equipments for which are being obtained from outside. For some time in 1933 and 1934, the English Electric Co. Ltd. owned and operated on the lines of the L.M.S.R. a 200 b.h.p. diesel-electric railcar but this is not at w rk now. On the North Sunderland Railway is a 95 b.h.p. Armstrong-Saurer oil-electric locomotive which operates the entire passenger and goods traffic of the railway. The Armstrong-Whitworth 800 b.h.p. locomotive was tried on the L.N.E.R., but is not now at work.

Irish Development

The first regular diesel service in the British Isles was inaugurated in 1931 on the County Donegal Railways, under the direction of Mr. Henry Forbes, and although the first, and a number of the subsequent cars, are only of 74 b.h.p., they have led to further developments in Ireland and have been visited by engineers from all over the world. At the moment the County Donegal Railways have five diesel cars at work and another under construction, and over 60 per cent. of the total mileage of the line is operated by them, and by a 74 b.h.p. diesel-mechanical locomotive. In 1932, another small Irish line, the Clogher Valley Railway, began a diesel railcar service over a most arduous route, and in the following year this was supplemented by a diesel locomotive of the same power, viz., 74 b.h.p., the engines, as in the County Donegal vehicles, being of the Gardner type. In these cars the power and transmission unit is mounted on one bogie, along with the driving cab and controls, the whole forming a separate unit which can be withdrawn from the passenger portion of the car. This form of construction was evolved by Mr. McClure of the Clogher Valley Railway in conjunction with Walker Bros. (Wigan) Ltd., and perfected in association with Mr. Forbes, and Mr. Howden of the Great Northern Railway. In some respects the Great Northern has gone further in its application of diesel traction than any other railway in the British Isles, for suburban traffic is operated by triple-car diesel trains. The Great Northern began its diesel traction experiments in 1932, and now has five railcars and the two trains just mentioned. On the neighbouring Northern Counties Committee line of the L.M.S.R. lighter suburban traffic at somewhat higher speeds is operated by two big double-bogie railcars, each powered by two Leyland 130 b.h.p. oil engines driving through partial-hydraulic transmission. Two diesel locomotives are under construction and one of them will have partial-hydraulic transmission and the other electric. The latter form of transmission is used also on the Belfast & County Down Railway, where a 270 b.h.p. locomotive has been at work since 1933 on the Ballynahinch branch, and another locomotive, of 500 b.h.p., is on order. The total number of railway diesels in the British Isles is thus 36 railcars, 38 locomotives, and two trains in actual service.

THE GREAT WESTERN DIESEL RAILCAR SERVICES

(From a Correspondent)



One of the 260 b.h.p. A.E.C. railcars at Weymouth

THE summer timetable of the Great Western Railway shows that its railcar services have grown to a total of almost 3,600 miles a day since the first streamlined car was put into service at the beginning of 1934. The footnote " X. Streamlined Rail Car, one class only (limited accommodation)," appears on nearly every page of the timetable, and it is found even as a connection on pages showing the cross-country services between Scotland and the north of England to South Wales and the west of England.

The first car was placed in service in the Slough and Reading area in February, 1934, and in July of the same year three more cars were introduced on an express service between Birmingham and Cardiff. In July, 1935, a further three started work in the Oxford and Worcester district, and ten more followed at the beginning of 1936. Of these 17 cars, 16 are used for passenger traffic, and the other is fitted with a special body for the conveyance of parcels.* The cars used on the Birmingham—Cardiff route seat 44 passengers; they are provided with a buffet for light refreshments and have two lavatories. Three of the remaining cars have lavatory accommodation but no buffet, and in all cars a small luggage compartment is provided.

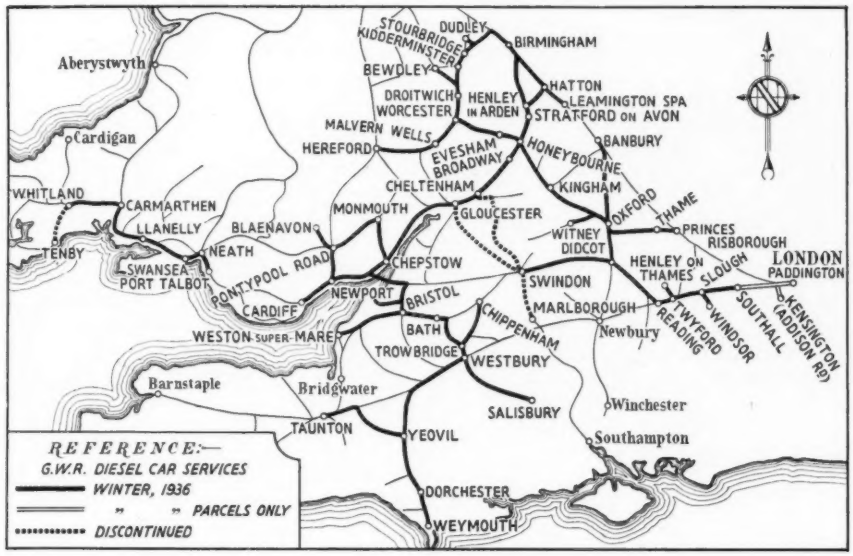
The chassis of these cars were designed and built by the Associated Equipment Co. Ltd., of Southall, and although railway practice was followed closely in the construction of bogies and underframes, other details were of the commercial vehicle type employing standard parts wherever possible. For instance, with certain modifications the engines and gearboxes are the same as those used on many buses in London and elsewhere. A special feature in the design of these cars is that all driving units are carried below floor level and on the outside of the underframe, so that the whole floor space is available for passengers or luggage, and all motive power and transmission constituents are readily accessible, and may be adjusted or even removed from the car without interference with the body. In fact, it can be claimed that any driving or braking part of the vehicle may be removed without pressing the wheels off the axles or without taking the bogies from under the vehicle.

In general construction all cars are similar, except the first vehicle which has one engine only. The two engines are placed approximately amidships and each drives through a fluid flywheel to a pre-selective type of epicyclic gearbox and thence through a reverse box to the inner axlebox of the bogie which, in addition to taking the weight of the vehicle, also contains the final drive. A similar axlebox is mounted on the outer axle and coupled by a propeller shaft to the inner one, so that both axles of the bogie are driven. The same arrangement of drive is mounted on the opposite side of the chassis. Although on test speeds up to 80 m.p.h. have been obtained, the cars are governed to give a maximum speed of 70 m.p.h. The main dimensions of the cars may be culled from the accompanying diagram.

From the experience gained in the running of the first seven cars, the bogies were redesigned with longer side bearing springs fitted with Spencer-Moulton rubber auxiliaries, and the bolster springs and swing links also were considerably improved. The result is that the riding of the later cars is much better than that of the earlier ones.

One of the last batch of cars near Malvern Wells

* Illustrated descriptions of these A.E.C. cars will be found in the issues of this Supplement for November 3, 1933, June 15 and July 13, 1934, and November 29, 1935.—ED., *R.G.*



Map showing the routes worked over by the A.E.C. diesel cars on the Great Western Railway. The service from Bristol to Avonmouth operates on Sundays only. The services from Cheltenham and Gloucester to Marlborough and from Whitland to Tenby were withdrawn at the end of the summer timetables

At the same time, the engines on these later cars were generally redesigned and fitted with cast iron crankcases, and the resulting improvement in running and maintenance is such that all earlier cars are being similarly treated.

Operation of the Cars

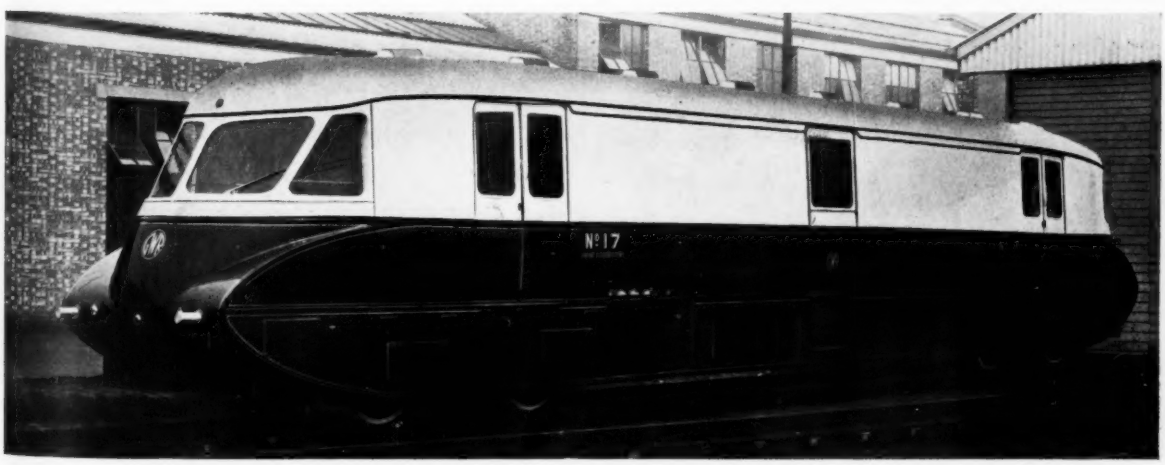
Of the 16 passenger cars, four are held as spares, a proportion which at first sight may appear high, but which is accounted for by the scattered disposition of services, extending from Tenby in the west to London in the east, and from West Bromwich in the north to Weymouth in the south, as shown in the map.

Nominally, spare cars are held at Birmingham (buffet type), at Newport on the north side of the Severn tunnel, at Bristol on the south side, and at Worcester. As under the regular maintenance scheme each car is withdrawn for examination after 25,000 miles, and the fleet of cars covers about 20,000 miles a week, it means that one car is usually out of service for this reason. The average fuel consumption on express services is approximately 8 m.p.g. while on stopping services it varies between 6 and 7 m.p.g. according to the frequency of stops and the distance between stations.

The busiest railcar centre is Oxford (summer timetables). Cars work from that city in five different directions, namely to Banbury, Hereford, Witney, Princes Risborough and Didcot, and there are 13 railcar departures and 12 arrivals daily, the difference being due to an empty run from Didcot last thing at night. During the 1936 summer timetables the fleet of cars was running over approximately 767 route miles and serving 217 stations and halts; a table showing an analysis of each car's Monday to Friday working during the summer is appended.

It will be seen that the highest mileage run is by the Bristol car which covers 355½ miles per day; at the bottom of the scale the Swansea car is running only 229 miles. An examination of the figures shows clearly the effect upon average speed of the number of stops made during the day; thus the Cardiff car, which stops only 14 times and has an average distance between stops of 20·39 miles, maintains an average start-to-stop speed of 48·1 m.p.h. On the other hand, the Pontypool Road and Swansea cars average only 29·5 m.p.h.; the Pontypool car makes 135 stops daily with an average distance between stops of only 1·78 miles.

The longest working day according to the timetable is



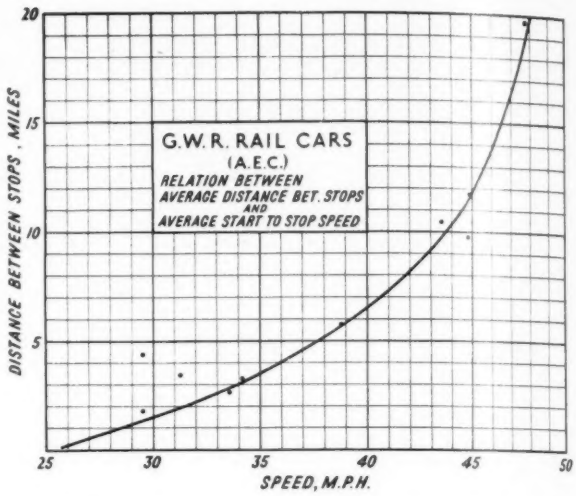
The 260 b.h.p. car introduced for parcels service down the Thames valley as far as Oxford

that of the Birmingham car which is in service for 15 hr. 8 min., and the shortest time is for the Cardiff car with a 9-hr. day, but these figures do not include empty running from shed, etc. The definite relation between speed and distance between stations is shown on one of the accompanying diagrams.

In order to prevent delay to passenger trains, an interesting and apparently successful experiment is being carried out in the London district. These trains now ignore parcels traffic, which is picked up later by a special parcels railcar. This vehicle leaves Paddington at 3.40 a.m. with a load to Addison Road, Kensington, where it picks up Messrs. Lyons' supplies for their depots and makes a non-stop run with them to Reading and then to Oxford. From Oxford the car returns to Paddington stopping at all stations and picking up parcels, and in the afternoon makes another all stations run to Reading and back.

TABLE I.—SUMMARY OF RUNNING, G.W.R. DIESEL PASSENGER RAILCARS SUMMER TIMETABLES, 1936

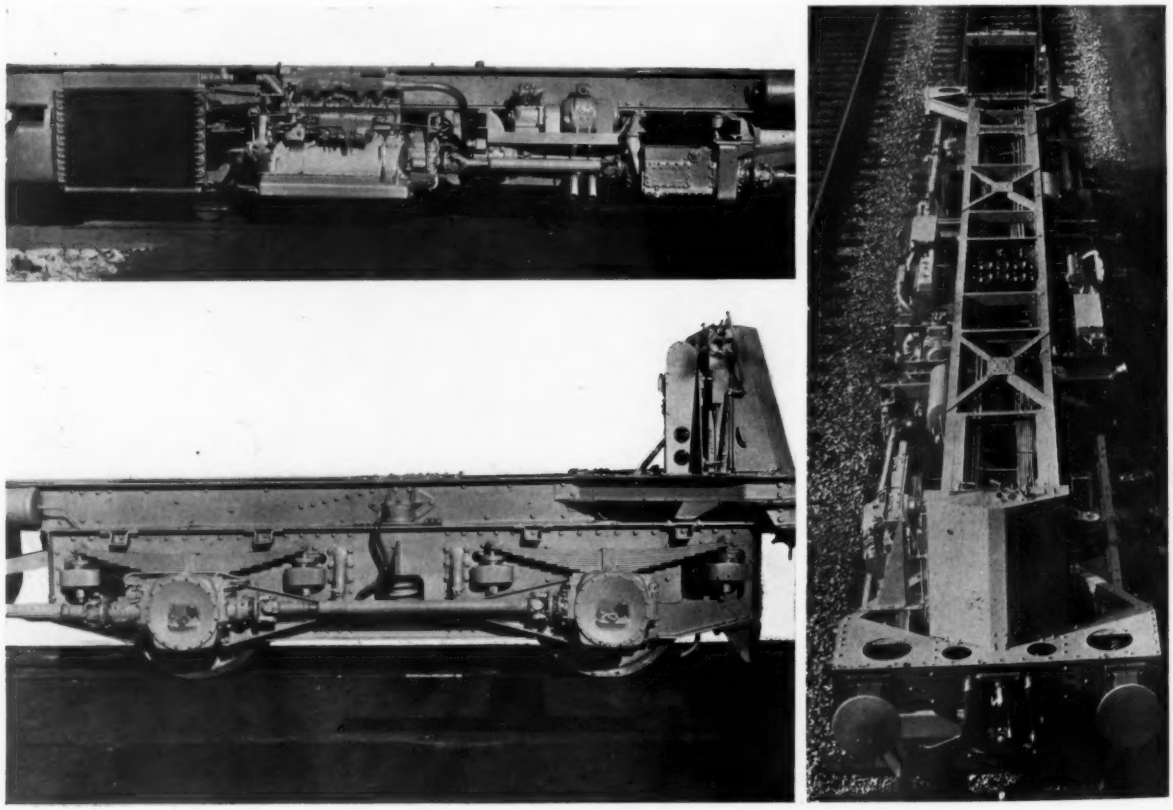
Car	Miles	Net Time, min.	Start-to-Stop Speed, m.p.h.	No. of Stops	Average Distance Between Stops, miles
Southall	238	408	35·0	69	3·45
Oxford A	307½	475	38·8	54	5·70
Oxford B	243½	427½	34·2	75	3·25
Bristol	355½	489½	43·5	34	10·46
Weymouth ..	282½	378½	44·8	29	9·74
Cheltenham ..	272	522	31·3	79	3·44
Pontypool	240½	489½	29·5	135	1·78
Worcester, No. 1 ..	250	457	32·8	102	2·45
Worcester, No. 2 ..	263½	470½	33·6	101	2·61
Birmingham ..	305½	407½	44·9	26	11·75
Cardiff	285½	356	48·1	14	20·39
Swansea	229	465	29·5	52	4·40
All Cars	3,273½	5,346	36·7	770	4·25



The relation between the start-to-stop distance and the start-to-stop speed

The mileage of this car is 222 daily, except on Saturdays when it is 150, and on Sundays when it is 132.

Adding the mileage of this car to the table given above, and also making allowance for traffic on Saturdays and other special trips, the cars between them are running 19,535 miles a week. This is timetable mileage; empty running, shunting and other movements bring the total to over 20,000 miles a week. The mileage being built up is thus over 1,000,000 a year, which is just about the



Three views of the chassis and bogie of the latest G.W.R. railcar

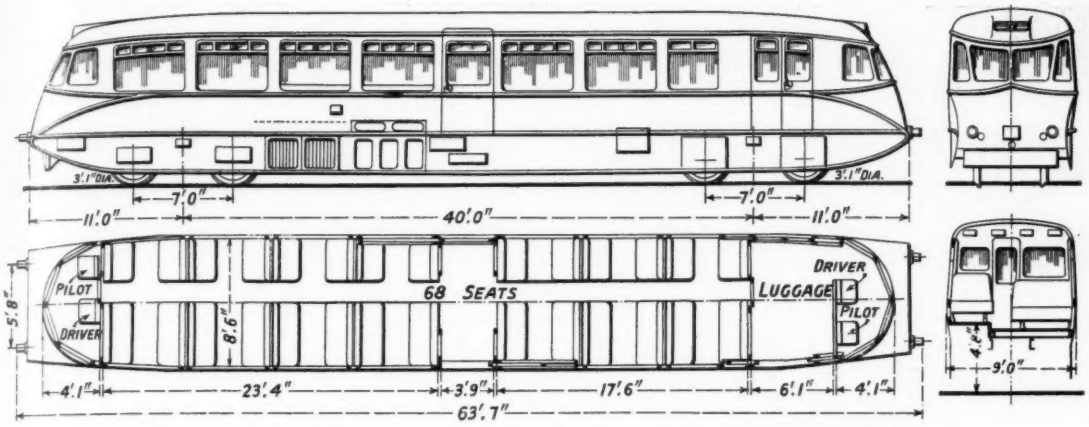


Diagram of the A.E.C. cars supplied to the Great Western Railway in 1935-36

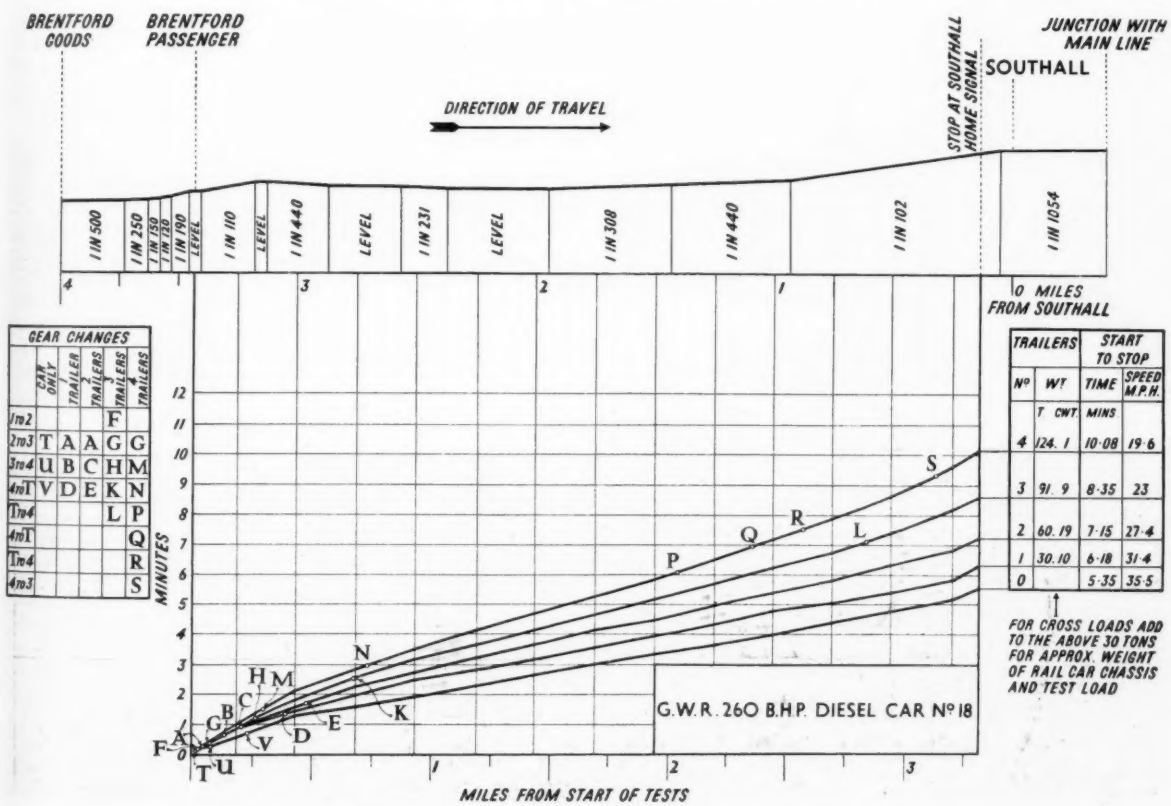
aggregate mileage that the cars have run to date. To this total the original No. 1 car, working in the Thames valley, has contributed over 150,000 miles. The average fuel consumption of this car is 8 m.p.g.

Table II shows that 14 runs are made daily at a speed of 50 m.p.h. or more, the highest booked run being from Castle Cary to Westbury, where the 19¾ miles are booked at 18 min., giving a speed of 65·8 m.p.h. No. 1 car with its single engine does the run from Reading to Appleford daily in 24 min., giving a speed of 48·1 m.p.h. for the 19¼ miles.

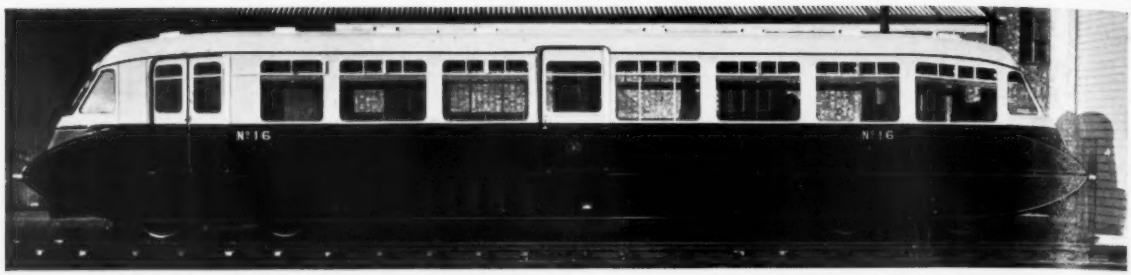
In their spare time, especially at week-ends, these cars are often used for football parties, weddings, mystery

TABLE II.—RUNS MADE AT OVER 50 M.P.H. G.W.R. DIESEL RAILCARS SUMMER TIMETABLES, 1936

Car	From	To	Time, min.	Distance, miles	Speed, m.p.h.
Weymouth ..	Castle Cary ..	Westbury ..	18	19¾	65·8
Worcester No. 2	Hall Green ..	Henley-in-Arden	13	12	56·5
Birmingham ..	Newport ..	Gloucester ..	49	44½	54·5
Birmingham ..	Birmingham ..	Cheltenham ..	61	54	53·1
Cardiff	Birmingham ..	Cheltenham ..	61	54	53·1
Cardiff	Newport ..	Gloucester ..	51	44½	52·3
Birmingham ..	Gloucester ..	Newport	51	44½	52·3
Cardiff	Cheltenham ..	Birmingham ..	62	54	52·2
Bristol	Frome	Yeovil (2 runs) ..	30	25¾	51·5
Birmingham ..	Cheltenham ..	Birmingham ..	63	54	51·4
Oxford A ..	Oxford	Kingham	25	21¼	51·0
Weymouth ..	Castle Cary ..	Yeovil	14	11¾	50·3
Worcester No. 2	Malvern Link ..	Worcester ..	9	7½	50·0



Performance of 260 b.h.p. G.W.R. railcar No. 18 when hauling trailers



One of the latest 260 b.h.p. A.E.C. railcars for solo operation on the G.W.R.

trips, and cheap excursions, and on these occasions high speeds are often obtained; for example, on one occasion the 77¼ miles from Swindon to Paddington was covered in 70 minutes. Another special run was made by a private party from Birmingham to Avonmouth. The route was via Oxford and 165 min. were allowed in each direction for the 141 miles. On the return journey, traffic delays resulted in the car being 17 min. late in leaving Bristol, but all of this time had been made up before reaching Oxford, the 74½ miles being covered in 68 min. inclusive of the slacks round Didcot West curve and elsewhere. For nearly half-an-hour the average speed was 70 m.p.h.

Trailer Haulage

Up to the present no use has been made of cars suitable for trailer haulage, but based on the experience which has been obtained, the A.E.C. has designed and built a new type of chassis which will shortly be placed in service. This car, according to the maximum speed required, may be used either by itself for high-speed work, or for hauling trailers, horseboxes or similar vehicles at a slower speed on branch lines and elsewhere, and standard buffers and drawgear are fitted for this purpose. It is designated No. 18 in the G.W.R. railcar list.

In order that it may be attached to one or more trailers, and be driven from these trailers in a similar manner to an electric train, special electro-pneumatic controls are employed, and these may be coupled easily to the trailers. In general, the design has been simplified, and although the same size of engine is used, the Wilson gearbox has five speeds instead of four; the bogie wheelbase has been increased from 7 ft. to 8 ft. 6 in., the pitch of the bogie centres from 40 ft. to 43 ft. 6 in., and the length of the car over headstocks to 62 ft.

Extensive trials have been carried out with this design in chassis form, and the results of an interesting test showing its haulage capacity are given herewith in graphic form. These tests were carried out between Brentford and Southall on a generally rising gradient, and a trailing load of no less than 124 tons was hauled in addition to the weight of the car with its test load, although this represents twice the load for which the car is intended.

Winter Services

Certain alterations have been made in the railcar services with the beginning of the winter timetables on September 28. The Swansea car service has been re-arranged and extended to Neath and Port Talbot, but the Whitland—Tenby run is discontinued. Owing to lack of support, the Cheltenham—Swindon—Marlborough service has been withdrawn, and a new one instituted between Bristol, Newport and Cardiff via the Severn tunnel. This is the first railcar working through that tunnel, and is possibly unique in that a " daylight " car spends more than 10 per cent. of its time in tunnels. Four return runs each way are made, stopping only at Stapleton Road and Newport except on one trip where a stop is made at Marshfield. In the afternoon one trip is continued to Weston-super-Mare and back. The mileage of the Bristol car, which already was the highest, has been increased to 402 miles daily by the addition of a return trip from Trowbridge to Chippenham, and from Bristol to Bath in the evening.

The running time of the 9.10 a.m. car from Cardiff to Birmingham is reduced by 5 min., bringing the speed from Cheltenham to Birmingham up to 54·0 m.p.h. The 18-min. timing from Castle Cary to Westbury is retained. The result of these and other slight changes is that the number of stations served is increased by one; the daily mileage is increased by 345 (including parcels car) miles to a total of 3,618; the route mileage is decreased by 25 miles to a total of 742; and Newport becomes the busiest railcar station with 14 arrivals and 14 departures daily.

One of the buffet cars running between Birmingham and Cardiff

TRANSMISSIONS FOR DIESEL LOCOMOTIVES AND RAILCARS

New Preselective Maybach Gearbox Giving Six, Seven or Eight Ratios

By STUART MIALL, B.Sc. (Eng.)

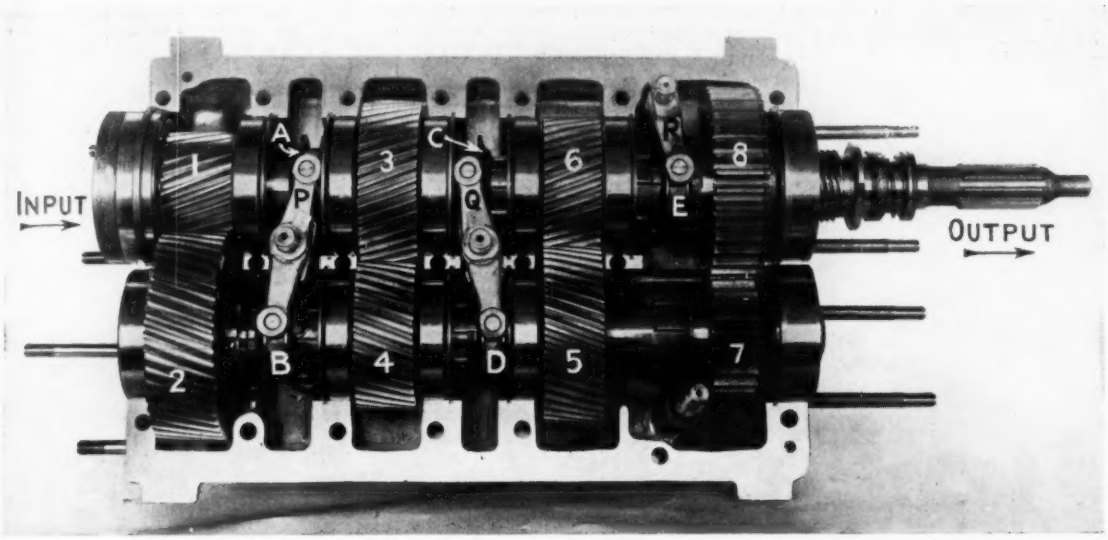


Fig. 1—Interior of new Maybach eight-speed preselective gearbox giving seven forward and one reverse speed

IN the issue of this Supplement for March 24, 1933, was published a description of the standard Maybach transmission, which is used extensively on the Continent. The same firm has now developed quite a new form of mechanical transmission, whereby as many as eight different ratios can be obtained although there are only four pairs of gears within the gearbox. Tried out extensively in commercial and other forms of road vehicle, the new transmission has proved efficient and reliable. Results no less satisfactory have been obtained with an experimental transmission fitted to an 18-ton railcar having a 12-cylinder 150 b.h.p. Maybach petrol engine. In this railcar the transmission has been arranged to provide six ratios in either direction, reverse being secured by the use of the conventional three bevel and sliding dog form of final drive.

The control in this railcar is extremely simple, there being only gear preselection, engine accelerator, and reverse levers. To start the car, first speed is preselected, and the engine accelerated. Gear changing from 1 to 2, 2 to 3, &c., takes place automatically when the engine attains its predetermined maximum speed. Motive power for shifting the dog clutches and performing the other necessary movements in the correct sequence is provided by the atmospheric air entering into a vacuum chamber via a control box, and an assortment of servo cylinders. The vacuum form of control is recommended, though a compressed air control is available. With a petrol engine the vacuum is obtainable by a connection to the induction manifold. With either vacuum or compressed air mediums it is easy to arrange for the remote control of any number of engine and transmission units. In the

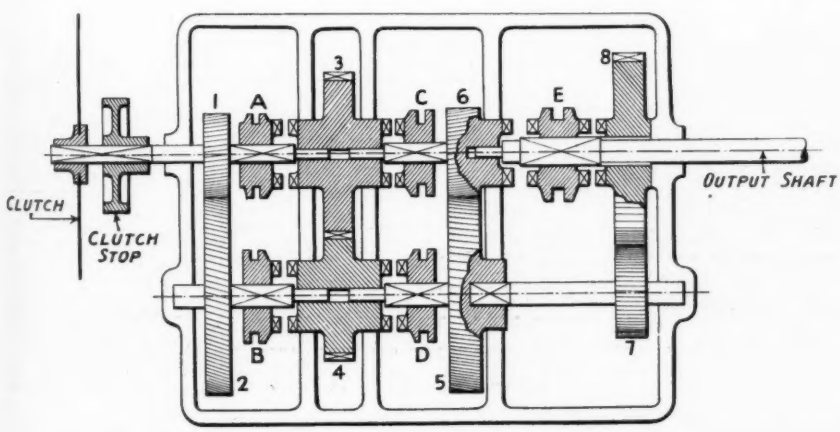


Fig. 2—Diagrammatic arrangement of Maybach seven-speed in both directions gearbox, as designed for rail traction work

railcar now at work gear changes down from any one gear to any lower gear are obtained by preselecting the required gear and momentarily easing the accelerator.

Construction of the Gearbox

Photographs and drawings of the railcar gearbox are not yet available, but there is a close resemblance between the railcar unit and the automobile unit portrayed in the illustrations accompanying this article. The main differences are that in the railcar all the gears are straight cut to obviate end thrust, and wheel 7 (Fig. 1) meshes permanently with wheel 8, the provisions shown for sliding it to the left being peculiar to the automobile type of box in which reverse is secured by selecting 1st speed after establishing the drive from 7 to 8 via intermediate gears on a short shaft not in the plane containing the axes of the wheels shown. Wheel 7 engages with the larger of the two intermediate wheels, and wheel 8 with the smaller. The reduction in reverse is thus greater than in 1st speed, being 10·1 to 1 instead of 8 to 1.

The construction of the box shown in Fig. 1 is diagrammatically portrayed in Fig. 2. In Fig. 2, however, gear 7 is shown fixed to its shaft as it would be in a railway application. It will be seen that, but for their intermeshing, and the clutch action of the dogs, the eight wheels would form seven rotationally independent units. Each unit has its own carrying shaft, or sleeve, and set of bearings. Wheels 5 and 7 are the only two which are constrained to revolve together as if mounted on a common shaft.

In the accompanying table are given particulars of the wheels used for the various ratios and the ratios themselves, these particulars being for the box portrayed. Fig. 3 shows the positions of the dog operating arms (and hence of the dogs themselves) for the various speeds.

MAYBACH GEARBOX

Speed	Reduction	Ratio of Gear Reduction to Following Gear Reduction	Wheels through which Drive is Taken
1	8 to 1 ..	1·4	1, 2, 4, 3, 6, 5, 7, 8
2	5·7 to 1 ..	1·4	1, 2, 7, 8.
3	4·07 to 1 ..	2·08	6, 5, 7, 8.
4	1·96 to 1 ..	1·4	1, 2, 4, 3.
5	1·4 to 1 ..	1·4	1, 2, 5, 6.
6	1 to 1 ..	1·4	Direct.
7	1 to 1·4 .. (overdrive)	—	3, 4, 5, 6.

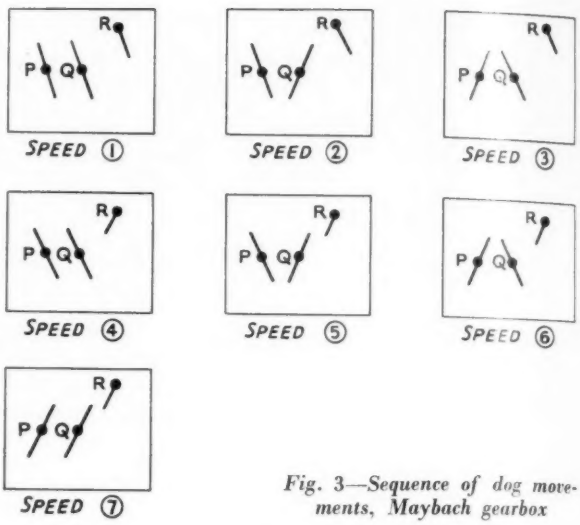


Fig. 3—Sequence of dog movements, Maybach gearbox

Change Speed Control

Fig. 4 illustrates the box with one cover removed to show the double-acting vacuum cylinders which control the dog operating arms. The left hand cylinder controls R (Figs. 1 and 2), the upper right hand cylinder controls Q, and the lowest cylinder controls P. Fig. 5 shows the control box with a steel rule placed alongside for comparison. The short length of spindle which is seen projecting, carries the gear preselection lever. A rotary disc valve is turned by an arm on the other end of this spindle, and keyed to the same spindle is an index plate notched to engage with a spring-loaded roller. By means of the disc valve is secured the movement of a number of small pistons and valves controlling the exhaustion and recuperation of the cylinders shown in Fig. 4. Other vacuum-operated cylinders work in conjunction with the accelerator, the clutch and the clutch stop, for, during a gear change, all these are manipulated as well as the gearbox dogs. A feature of the vacuum control with its many little

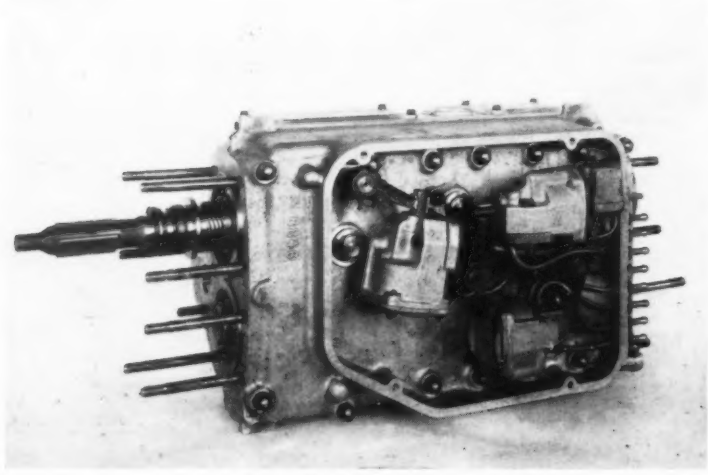


Fig. 4—View of Maybach eight-speed box showing operating cylinders

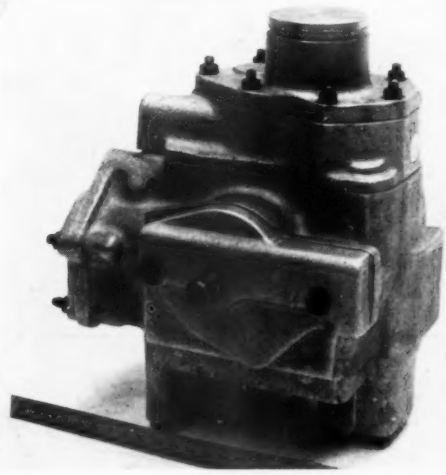


Fig. 5—Control box for Maybach change-speed gear

pistons and plungers is the relatively easy fit of all these and the absence of any rings or packings. No lubrication is necessary anywhere within the control system and hence it is impossible for any part to become sticky or unreliable in operation. Approximate synchronisation is secured automatically by clutch, clutch stop, and accelerator controls before the gearbox dogs are brought together, so that masking rings and synchromesh devices are not provided. Instead, the dog claws are given slightly inclined entering faces as shown in Fig. 6, this enabling them to be brought together with safety whenever relative motion is as shown by the arrow. This arrow gives the motion of M relative to N, and Fig. 6 represents the condition obtaining in practice when contact is first established between a pair of dogs. N is accelerating, or M is retarding, or both effects occur simultaneously, so that eventually synchronisation occurs and the dog M enters fully into the dog N. Then, and only then, is the main clutch engaged and power transmission recommenced.

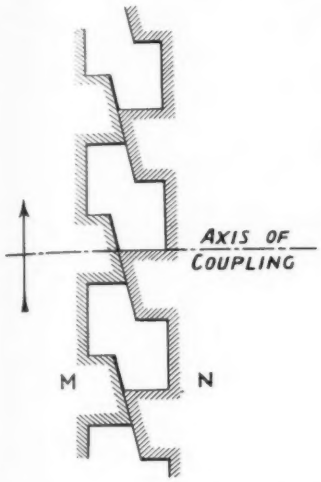


Fig. 6 — Development (diagrammatic) of the outer peripheral surfaces of the Maybach dog coupling

Practical Demonstration

Experience has shown that changes from top to 1st or 1st to top can be made in rapid succession, and the only evidence of any change is afforded by the engine revolution counter. The transmission of a high power through one pair of gear wheels after another, *e.g.*, through 4 pairs as in 1st speed, might be expected to lead to the development of much noise. Noise in gearboxes usually is attributable to a want of rigidity in the shafts, which causes the gears to run out of proper alignment. In the Maybach box all the shafts are short and very rigidly supported, and due partly to this, and partly to the accurate manufacture of the gears themselves, the working of the box is inaudible in both direct and indirect speeds. The loss of power is claimed to be about 1·0 per cent. per pair of wheels, and the overall efficiency under the most trying conditions may therefore be expected to approximate to 95 per cent. Owing to the large number of gear ratios, and also to the accuracy of the automatic control, the main clutch is not required to slip with its working faces making contact, and experience has shown that this, and all the other parts of the transmission, enjoy a long life. However, in some applications it is proposed to incorporate a Vulcan-Sinclair fluid coupling in the drive. Maybach gearboxes for use in this country are to be manufactured by David Brown & Sons Ltd., of Huddersfield.

SOME RUNS ON THE L.N.E.R. DIESELS

(From a Correspondent)

THE L.N.E.R. Armstrong-Whitworth diesel cars, which are allowed 52 min. for the 42¼ miles non-stop run between Hull and York and are restricted to a maximum speed of 65 m.p.h., have no difficulty in improving on this schedule. On a recent occasion *Lady Hamilton* made the run from Hull in 47 min. 9 sec., including a slight slack through Beverley, a reduction to 28 m.p.h. at Market Weighton, and a very slow approach to York from Bootham junction. The maximum speed for a very short distance near Warthill was 66 m.p.h. and the passing times were from Hull to Beverley (8¼ miles) 10 min. 4 sec.; Market Weighton (19¾ miles) 22 min. 24 sec.; Pocklington (26¼ miles) 29 min. 22 sec.; and Bootham junction (40½ miles) 44 min. 6 sec. The return trip from York to Hull was made in 46 min. 39 sec. with a brief maximum of 68 m.p.h. near Cherry Burton, and passing times of 3 min. 20 sec. to Bootham junction; 17 min. 47 sec. to Pocklington; 24 min. 21 sec. to Market Weighton (where speed was reduced to 32 m.p.h.); and 36 min. 21 sec. to Beverley. The car was very well loaded on the return journey at 4.48 p.m. from York to Hull (the seating capacity is 60, with ample luggage space), and the running was fairly smooth, though noticeably better when the engine end of the car was trailing. The same car makes two double trips daily between Hull and Pontefract (via Selby), where connections are made with York-West of England trains, so that a substantial and long-needed improvement has been made in the service between Hull and Birmingham. On these trips the car is booked to cover the 31 miles from Hull to Selby in 36 min. This run was made by *Lady Hamilton* with ease in 32 min. 39 sec. without exceeding a maximum of 64 m.p.h., which argues well for the success of the cars on short cross-country journeys of this nature, many of which are in urgent need of acceleration, although their length may not warrant the running of a non-stop steam express nor require restaurant or lavatory facilities, which the L.N.E.R. diesels do not provide.

Between Leeds and York the cars are allowed 33 min. for the 25½ miles non-stop run, as compared with 30 min. by the steam non-stops. Coming from Leeds on the 11.5 a.m. trip, *Northumbrian* was very badly delayed all the way to Micklefield by a Scarborough special, which left Leeds in the timing of the railcar, although, in view of the diesel's rapid acceleration, little if any delay would have been caused had the car been given preference. From Micklefield (passed at very low speed), *Northumbrian* covered the 13¾ miles to Chaloner's Whin in 14 min. 37 sec. with a maximum of 64·2 m.p.h. at Bolton Percy, but the running at anything over 55 m.p.h. was distinctly rough. Some change has been made in the timetables to which these cars operate since these runs were made.

ROUMANIAN DIESELS.—It is reported that a contract for a 4,000 b.h.p. diesel-electric locomotive is to be placed with Sulzer Bros. by the Roumanian State Railways. The engines are to be of similar type to those now being installed in the P.L.M. express locomotives. Even allowing for the grades and curves of the Campina-Brassov line it would seem that such a power is excessive, and it is possible that any such locomotive will be in two complete units, either of which will be capable of main-line haulage without assistance.

THE DEVELOPMENT OF THE HIGH-SPEED OIL ENGINE

Mr. Ricardo describes post-war work

AN exceedingly interesting account of the development of the high-speed oil engine in Britain during the past 17 years was given by Mr. H. R. Ricardo, F.R.S., in his paper entitled "High Speed Diesel Engines" read before the British Association for the Advancement of Science at Blackpool last month. Confining himself mainly to the problems of obtaining efficient and controlled combustion, beginning from the experiments made at the Royal Aircraft Establishment just after the war, Mr. Ricardo described his own research work, conducted mainly with a sleeve-valve engine during the years 1920-23, and embodying investigations with direct injection, precombustion chambers, and the Bosch-Acro air cell. A definite improvement was registered by reverting to an open chamber head and fitting baffles to the inlet ports, thus introducing a definite rotational swirl.

Further experiments with a sleeve-valve engine, in which the air was admitted to the cylinder almost tangentially, and a cylindrical combustion chamber shaped like a top hat was incorporated, gave further improvements, and the eccentric location of the fuel injector combined with the rapid swirl of the air was found to have removed the bogey of dribbling. It was possible to maintain a brake m.e.p. of 100 lb. per sq. in. at 1,800 to 2,000 ft. per min. piston speed, and with a fuel consumption of 0·36 lb. per b.h.p. hr.—notable achievements for the year 1935. Investigations showed that for the best results the speed of the air swirl, as recorded by an anemometer, should be about ten times the crankshaft speed, and this ratio has been used ever since. The sleeve-valve type of engine was taken up by Peter Brotherhood Ltd., and with the Brotherhood-Ricardo design has been used successfully all over the world.

Research for Transport Engines

For road vehicle engines, however, it was felt that prejudice against sleeve-valve engines would be hard to overcome, and attention therefore was turned towards the poppet valve type, and an effort made to apply the experience gained with the sleeve-valve engines, principally by using a single hole injector in combination with an intense air swirl. Owing to the necessity of valves in the head, the ordinary top hat combustion chamber could not be used, so it was overturned into the piston head. In order to obtain the necessary swirl, the air inlet passage was formed to give a tangential flow, and the head of the inlet valve was recessed and partially masked. Extensive trials in the laboratory and on the road showed that with this design a brake m.e.p. of 90-95 lb. per sq. in. could be maintained with a clean exhaust up to 1,200 r.p.m. and with a fuel consumption of 0·41 lb. per b.h.p. hr. Above this speed the performance was even more inferior to that of the previous sleeve-valve engines.

Further efforts resulted in the adoption of a spherical combustion chamber connected to the cylinder by a tangential passage of relatively large area, and the use of this gave smooth running, good power output, and a clean exhaust, but with a fuel consumption of 0·42 lb. per b.h.p. hr. Many of these engines were built and have been used with great success, but it was felt that further improvement could be made.

The Ricardo Comet Head

Extensive research on combustion generally and on diesel fuels and their characteristics, showed that stable aldehydes, responsible for the acrid diesel smell, were formed whenever the flame was allowed to impinge against a relatively cold surface; under these conditions the process of combustion was brought up short, and products of partial combustion were stabilised as such.

The next road vehicle engine therefore was designed with a combustion chamber in which the lower half of the sphere containing the tangential passage, and against which the fuel jet impinged, was made in the form of a loose member made of heat-resisting steel and insulated from the water-cooled head by a small air gap. By this means the smell was eliminated, the hot member was used as a heat regenerator to recover some of the heat lost by the transfer of the working fluid to and from the combustion chamber, and a higher compression temperature gained, so that the delay period was reduced and a better control over the burning was obtained. This is the well-known Ricardo, or Comet, head.

In 1929-30 this was applied to the A.E.C. engine, then operating with a Bosch-Acro head and giving 85-90 b.h.p. After conversion the power output was raised to over 130 b.h.p. at 2,300 r.p.m. with an engine-weight of 13 lb. per b.h.p. The maximum brake m.e.p. with a clear exhaust is about 103 lb. per sq. in., and this can be maintained up to high speed. The fuel consumption at an economic load is about 0·4 lb. per b.h.p. hr. Despite prolonged and drastic testing, the first batch of these engines was not immune from trouble once they got on the streets. There were cracked cylinder heads and big-end bearing failures. The first of these was overcome, as a temporary expedient, by the use of aluminium alloy in place of cast iron, and, as a permanent remedy, by slitting the multiple cylinder head casting between each cylinder bore to allow of freedom of expansion, and also by directing the flow of water at high velocity across the cylinder heads in order to scour away steam pockets and the deposition of sediment. The second trouble eventually was overcome by the substitution of a lead-copper bronze in place of white-metal linings. The satisfaction given in service by these engines, and the numerous others built subsequently, has been such that the number of vehicle miles per involuntary stop of a London diesel-engined bus now is three times that of the petrol engine. Over 20,000 of the Ricardo Comet heads are in regular service on the roads (and rails) of Europe, the aggregate horsepower being about 1,500,000.

The high specific output of these A.E.C. engines led to the demand for much smaller engines running at still higher speeds, and this demand accentuated until the full tax of 8d. per gal. was applied to fuel oil. This imposition proved a serious blow to the development of the diesel engine for the lighter classes of lorry in this country. The smallest diesel engine yet designed as a commercial product is a four-cylinder engine developing 47 b.h.p. at 3,800 r.p.m., and having cylinders of $2\frac{7}{8}$ in. diameter by 4·0 in. stroke.

Up to the present all large oil companies have been anxious to encourage the development of the diesel in order to absorb their surplus of heavy distillates. Today the balance is almost reached, and the diesel engine of the near future will have to be content with a much inferior fuel. Two forms of combustion chamber have been evolved for future use, one to use fuels of a low cetene value and to give easy starting with smooth and silent running, and the other, by a reduction of pumping and heat loss, to give high output and low fuel consumption.

SPANISH LOCOMOTIVES FOR MARSHALLING SERVICE

DESIGNED for station yard service, two 30-ton diesel-engined locomotives, of which one is illustrated herewith, were built in 1935 by the Maquinista Terrestre y Maritima, of Barcelona, for operation over M.Z.A. lines. One of the locomotives is powered by a four-stroke 200 b.h.p. engine of the Deutsche Werke, Kiel, type and the other by a two-stroke 210 b.h.p. Burmeister & Wain engine. Apart from this difference in engine make and a variation in the ratio of the gear reduction, the two locomotives are identical.

Dimensions of the locomotives are shown on the accompanying diagram. The frame structure is electric-arc welded of heavy plates, some of them 35 and 40 mm. thick, and as a result of this necessity for adhesion weight the construction of the mechanical portion is exceptionally robust. The engine is mounted directly on a bedplate built up from the locomotive frames by welding. Side buffers and an automatic coupling gear are fitted. There are two types of brakes, a Korting vacuum brake and a counterbalanced hand brake. The vacuum apparatus is suitable for applying that type of brake on a train of wagons weighing 100 tons at a speed of 20 m.p.h., as well as on the locomotive itself. These locomotives have shown themselves capable of starting and hauling on the level a trailing load of 860 tons on the first gear step and a 212-ton train has been hauled on the straight level at the top speed of 19 m.p.h.

Engine and Transmissions

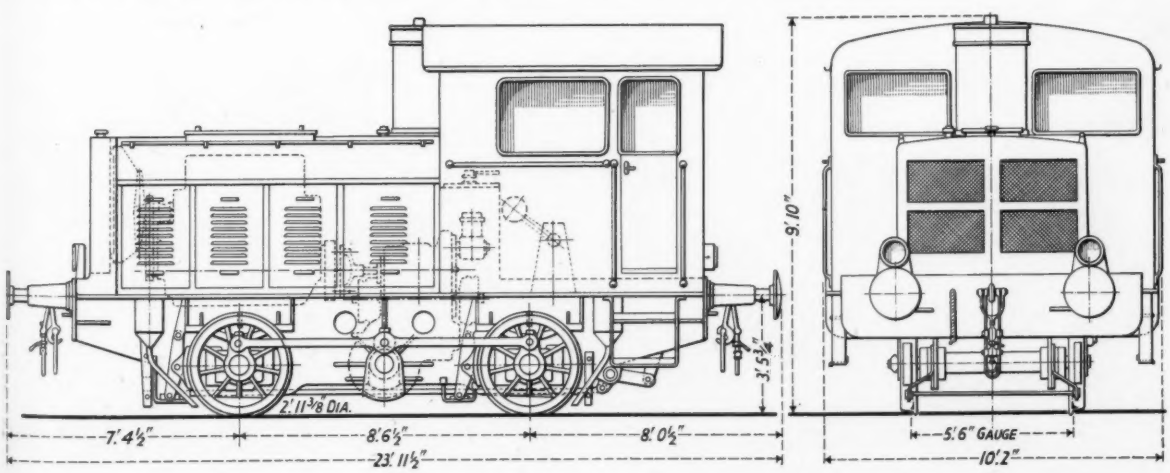
The characteristics of the two types of engines are as follows:—

	B. & W.	D.W.K.
Type	2-stroke	4-stroke
B.h.p.	210	200
R.p.m.	1,200	1,000
No. of cylinders..	5	5
Cyl. bore	135 mm.	160 mm.
Piston stroke	220 mm.	240 mm.

In both cases mechanical transmission of the T.A.G. (Triebwagenbau Aktien-Gesellschaft) pneumatically-operated type is fitted. There are four speeds in each direction; reversing is effected through a double bevel arrangement. The final drive is through a geared central jackshaft and coupling rods. The ratios in the gearbox are 6·07, 2·7, 1·52, and 1·1 to 1, and virtually similar rail speeds are obtained by a variation in the ratio of the wheels on the jackshaft, to compensate for the difference in the rotational speeds of the D.W.K. and B. & W. engines. With normal engine revolutions the rail speeds in the different gear steps are 4·0, 7·2, 12·8, and 19·2 m.p.h.

210 b.h.p. locomotive with D.W.K. engine

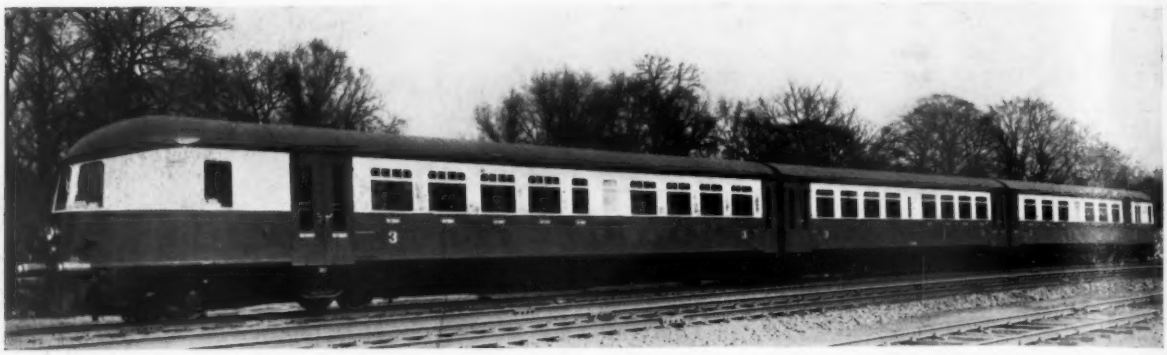
Electric starting for the engines is employed in each locomotive, but the D.W.K. engine has a 15 h.p. Bosch starting motor and the B. & W. engine two 6 h.p. Bosch starters. A 500-watt dynamo is used to charge the 300 amp. hr. 24-volt lead battery, and supply current to the lighting equipment, which comprises two 40-watt head lamps and four 25-watt signal lamps with red and green glasses. The cab fittings include engine-speed control handle, fuel regulator, reversing handle, vacuum brake handle, balanced lever for hand brake, sanding levers, Typhon horn control, engine rev counter, vacuum gauge, and cooling water temperature indicator. Performance so far has shown that in an hour of normal shunting work the fuel consumption is about 15·5 lb., and that the distance covered in an eight-hour day is 27 to 31 miles. Per tonne-km. the fuel consumption has averaged 4·6 gr. with the D.W.K. engine and 4·0 gr. with the Burmeister & Wain engine. The fuel capacity is 400 kg. (880 lb.), sufficient for over 50 hr. of normal duty.



Layout of diesel-mechanical locomotive used at Barcelona by the M.Z.A.

BELGIAN STREAMLINED TRAIN

One of four designs recently set to work on fast interurban traffic



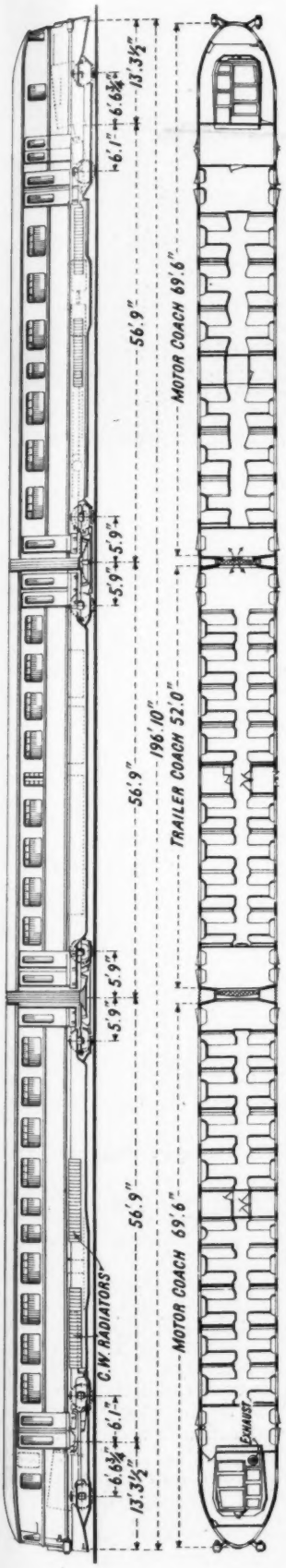
800 b.h.p. oil-electric train of the Belgian National Railways

AMONG the eight triple-car oil-electric trains delivered to the Belgian National Railways during the summer were three rakes built by Baume-Marpent, and powered by two Carels-Ganz engines with a continuous output of 380 b.h.p. each. In common with the other five trains, these sets have a seating capacity of 229 in two classes, and are allowed a top speed of 87 m.p.h. The three cars of each train are articulated and carried on four bogies, the outer pair carrying the engines and main generators and the inner pair the traction motors. The tare weight of the train is 138 tonnes, giving ratios of 5·8 b.h.p. per tonne of tare, about 5·1 b.h.p. per tonne of gross weight, and a weight of 1,350 lb. per seat.

One of the end carriages is devoted to second class passengers, and there are 52 seats (including four tip-up seats in the vestibules) divided into smoking and non-smoking compartments. The other end car and the trailer in the centre house an aggregate of 177 third class seats. The train is built up on welded steel framework, with steel outer panels and wood inner panels, and is shaped to a streamlined contour developed from the form of the 410 b.h.p. twin-car train which has been in service since May, 1933. The underframe and body framework are welded up as an integral structure with particular rigidity at the ends, the noses being built up to provide great resistance in the event of a collision. The outer panel plates are 2·5 min. thick and 1·0 mm. thick below floor level where they form the streamlined shrouds.

Below the main longitudinals is mounted a variety of equipment, access to which is gained from below the vehicle and through small hinged doors. The equipment so located includes the cooling water radiators, the storage batteries, brake reservoirs, and part of the heating and ventilating equipment. Over the underfame the floor is formed of a 30 mm. layer of Forcometal covered with magnesium cement to prevent corrosion. In the second class compartment this is topped by an 8 mm. layer of cork compound and a layer of linoleum, but in the third

400 b.h.p. Carels-Ganz engine with its main generator mounted on Wumag-type bogie



229-seater welded-steel oil-electric train for use on fast point-to-point schedules, Belgian National Railways

class saloons the magnesium cement itself forms the top layer. The inner side and cross panels are formed of woods from the Congo, and the cross panels near the engine rooms are lined with Celotex. The second class seats have wooden frames mounted on chrome-steel supports, but the supports for the third class seats are of Anticorodal. Small window tables are arranged between each pair of seats. The windows are of Sécurit glass and are fixed, but deep ventilating sections are fitted just below the cantrail. The doors are closed by air pressure from the driving compartment. The lighting is on a 96-volt circuit with the lamps arranged down each side of the ceiling.

Forced ventilation and carriage heating is on the Westinghouse system. In winter, air is drawn in, filtered, and forced by a fan across one or two of three heating agents, *viz.*, hot water, steam, and electricity. The heated air is led down ducts at the bottom of the side panels and admitted to the passenger saloons through diffusers beneath the seats. The vitiated air is led out through ducts in the ceiling, the suction force being provided by a fan. Thermostatic control is used to regulate the temperature. In summer the flow of air is reversed by merely turning one cock at the air entrance, and the air is then introduced through the ducts in the ceiling and the vitiated air drawn out through the diffusers under the seats. Normal heating of the air is effected by the engine cooling water. A pump forces a certain part of the hot water from each engine to the heating portion of an air conditioner located on the centre vehicle. The action of this pump is controlled thermostatically. If the oil engines are stopped, or working well below rated output, the heat in the cooling water decreases, and when this occurs electric resistances are brought into action automatically, and the air passed over them until such time as the heat in the cooling water can once more provide the necessary temperature, or until the main electric circuits are again being used to a high degree for traction purposes. Preheating of the trains when standing in stations can be effected either by electricity or by steam from a convenient supply.

Bogies and Brakes

Both types of bogies are of welded steel construction and are carried on Timken roller bearing axleboxes. The engine bogie is of the triple-suspension Wumag type, the axleboxes being supported by laminated and helical springs, and the body on a non-swing welded steel bolster carried by two inverted laminated springs. The traction motor bogies have a swing bolster supported on two longitudinal laminated springs at each side, and the weight of the body is transferred through the centre pivot and two side bearers.

Westinghouse air brakes are fitted and apply two shoes on the drums attached to each wheel. Each of the eight shoes on a bogie is actuated by a brake cylinder of its own, and is lined with Ferodo. Independent handbrakes are fitted in both driving compartments.

Motive Power

The Carels-Ganz engine has eight cylinders in line with a bore and stroke of 6·7 in. by 8·7 in. and develops 380 b.h.p. at 1,400 r.p.m. The top short-time rating is 400 b.h.p. at 1,450 r.p.m., and at this output the brake m.e.p. is 89 lb. per sq. in. and the piston speed 2,090 ft. per min. The weight is about 17 lb. per b.h.p. on the continuous rating. The cylinder block and cylinder heads are of cast iron and the crankcase, sump, and valve gear casings are of silumin. A pre-combustion chamber of the Jendrassik type is fitted in each cylinder head and two atomiser nozzles are led into it. The fuel pump is of the Ganz type.

The electrical equipment was supplied by the Société Electro-Mécanique, and comprises a d.c. main generator and overhung auxiliary generator for each engine, and four 210 h.p. nose-suspended traction motors. Each engine-generator group supplies current to the two adjacent traction motors, but each auxiliary generator can supply current for all the auxiliaries, including battery charging, train lighting, signal apparatus, and the air compressor for the brakes, control equipment and doors.

GERMAN RAILCARS.—The four double-bogie railcars of the Reichsbahn powered by supercharged M.A.N. engines developing 560 b.h.p., which were described in the issue of this Supplement for August 7, tare only 47 tons, giving a ratio of 11·9 b.h.p. per ton of tare. With fuel, oil, and other supplies the weight is 49 tons. During trials conducted after those detailed in the above-mentioned article, a speed of 37 m.p.h. was maintained up a grade of 1 in 50 with a length of 21 miles. The 112 miles from Offenburg to Constance, including the heavy grades of the Black Forest railway near Triberg, and a further ascent between Donaueschingen and Singen, were covered in 180 min., including ten stops aggregating 20 min. In both cases a trailer was being hauled, the total train weight being 78 tons.

PERFORMANCE OF A 500 B.H.P. RAILCAR

Intensive service trials have been made with the first railcar of 500 B.H.P. to have mechanical transmission

500 b.h.p. Renault car used on the French State Railways

THE 500 b.h.p. Renault single-engine diesel-mechanical railcar which made the record run over the Est and Alsace-Lorraine systems in December (see issue of this Supplement for January 24) has been working on the French State Railways in the La Rochelle district since the beginning of the year.

Between January 6 and June 9 the vehicle covered 111,961 km. (69,750 miles), making a normal daily journey of 956 km. (592 miles) on the La Rochelle—Rochefort—Tours—Rochefort—Poitiers—Rochefort—La Rochelle circuit. This trip was missed only on 12 scheduled occasions, when the car was in the shed for various causes not allowed for. Of the 154 days it was at La Rochelle it worked 117 days.

Running repairs were carried out by two or three workmen each night between the hours of 0.25 and 4.25. After each 8,000 km. (4,960 miles) the car was laid off as a matter of course for 24 hr. in order to inspect thoroughly the details of the mechanical portion and the controls. Every 46,000 km. (28,500 miles) it was laid off for 48 hr. in order to inspect the engine and clean the valves, in addition to a complete inspection of the vehicle and normal maintenance work.

At the request of the maker the car was withdrawn in June in order that the engine and transmission might be taken down and observations made as to the wear and general condition of the constituents, as this was the first Renault 500 b.h.p. engine and transmission to be put into service. Apart from the needle-roller bearing articulated joint in the connecting rods and the similar bearings at the gudgeon pins, which showed signs of scoring and overstress, the engine generally was in good condition. These bearings have been replaced by others of the plain bronze type and this practice has been extended also to the standard 12-cylinder 265 b.h.p. Renault engine, in which similar trouble has been experienced.

Despite the great power transmitted through the clutch, its general condition was excellent, but it had been adjusted after 50,000 km. (31,000 miles). Some slight trouble was occasioned by the gearbox during the five months in service, mainly owing to a fault in lubrication in the drive between the primary and secondary shafts, which prevented the synchronised action of the gears.

The rated output of the engine is delivered at 1,500 r.p.m., corresponding to a road speed of 150 km.p.h. (93·2 m.p.h.) on top gear, and some of the success attending this five months' trial must be credited to the fact that most of the time the engine was working well below its rating, the normal outputs being 250 to 300 b.h.p. at 800 to 1,200 r.p.m. But for a vehicle of this type, with a relatively big engine, it is essential not only that a big daily mileage be worked, but that the availability be high and the maintenance cost low, in order that the fixed charges of the more expensive car may be recouped. The performance of this Renault car along these lines has certainly been encouraging.

FUEL COMBUSTION IN HIGH-SPEED OIL ENGINES

A paper on the desiderata, and on a recent design

THE paper on " Diesel Engine Combustion Research " read by Mr. A. Freeman Sanders, of John Fowler & Co. (Leeds) Ltd., in May before the Diesel Engine Users Association, has been printed by that organisation, complete with discussion.

Mr. Sanders considered that four basic features in the design of combustion chambers were:—

1.—The surface area to volume ratio should be as small as possible in conjunction with fulfilling the other points set out below. There should be no restricted passages through which hot air and gases have to travel.

2.—Intimate mixing of the oxygen with the fuel is necessary to obtain clean combustion and high power output, so that some degree of turbulence, preferably in the nature of a rotary swirl, is a necessity.

3.—The lowest possible pressures, consistent with good combustion, should be used in the injection system and preferably this should be combined with a simple single-hole or pintle type injector.

4.—At the commencement of injection the spray should issue into an atmosphere which is non-turbulent, unless the injector is so placed that the small globules of fuel

have some considerable distance to travel before they strike, or are dashed against the wall of the combustion chamber; otherwise quick ignition of the fuel will not take place, the result being a long delay period with consequent rough running.

The direct injection and ante-chamber types of engines were dealt with in some detail, and the author considered the second type fundamentally unsound, although recognising that in the early stages the precombustion chamber offered a convenient way of obtaining satisfactory combustion. On the other hand the air cell was an important development; the Acro type met the four basic requirements of design in the following way.

1.—The surface area to volume of the piston chamber is, of course, nothing like as good as the direct injection engine, and it has the further disadvantage that it has a very small passage through which hot air has to travel, so that it does not conform to this item.

2.—The intimate mixing of the oxygen with the fuel is good, but very high power outputs are not obtainable owing to the fact that so much of the combustion takes place too far past top dead centre of the piston to be really effective.

3.—With this system, low injection pressures, combined with a single-hole pintle type injector, are used, and therefore it conforms ideally in this respect.

4.—There is no doubt that engines of this type are difficult to start, unless some means of applying heat is employed. At a first glance, it would appear that the starting should be good, as the injector sprays into a small chamber at the side of the cylinder, only a small portion being carried into the ante-chamber. It would therefore appear that starting should be nearly as good as in a direct injection engine, and this would undoubtedly be so but for the fact that the injector is in the turbulent stream of air as the piston approaches top dead centre, and dashes the finer particles of the spray against the walls of the combustion chamber.

The Discussion

A brief description of the cup-shaped air cell evolved by the author and used in the Fowler-Sanders oil engines was given, and illustrated by sketches of air flow. Mr. Sanders claimed that this type of head gave good combustion and resulted in a fuel consumption curve almost flat from half to full load, but he was taken to task, especially by Mr. W. A. Tookey, for the sketchy way in which he backed up his claims, after having described fully other people's inventions. Mr. Tookey thought that the consumption of 0·375 lb. per b.h.p. hr. claimed by Mr. Sanders should be more like 0·4 lb., but no information as to engine speed was given.

Referring to the Comet type of air cell head Mr. S. J. Allcock, of Ricardo Limited, said that these did not increase thermal efficiency through reducing the heat loss by reason of the heat-insulated throat. What they actually did was to affect the actual behaviour of the engine. With a very hot throat the air going through on the compression stroke became highly heated, giving prompt ignition and quiet running. Again, on the outflow, any partially-burned fuel which was chilled on the cold upper part of the combustion chamber came into contact with the hot walls of the throat and was burned completely. That eliminated the "diesel smell," which was due to aldehydes and other products of partial combustion. Owing to the increased heating effect of the throat as the speed increased, the ignition delay was reduced, and thus it was possible to use a constant injection advance over a wide angle.

Injection pressures were touched upon by Mr. S. J. Davies, who said that tests he had conducted with an engine of 100 b.h.p. had shown that even with injection pressures up to 12,000 lb. per sq. in. and with unfavourable conditions, the power put into the oil injection was less than 1 h.p., to which Mr. Sanders replied that high pressures usually were associated with very fine nozzle holes, which were not easy to clean, and which were liable to give more trouble than injectors having a large single hole with low injection pressures. Contrasted to Mr. Sanders' view, Mr. Davies supported the contention that the precombustion chamber engine would burn a wider range of fuel than the direct injection type.

Mr. Cornewall-Walker emphasised that with precombustion chamber engines it was necessary for close attention to be paid to the exact timing of the fuel admission and the absolute elimination of dribble. If it were possible always to use the most suitable fuel the means for effecting complete combustion would be much simplified. This last statement of Mr. Cornewall-Walker's is borne out in striking fashion by experience on the Canadian National Railways, an account of which was given in our issue of August 10, 1934, by Mr. R. C. Gage. Mr. Cornewall-Walker said that he had obtained excellent results in service with a number of precombustion chamber oil-engines installed in diesel locomotives.

Mr. Paxman supported Mr. Tookey's criticism that it would have been more interesting to have further description of the Sanders' design, and drawings of the engine, in the paper rather than having to ask for them in sales literature. The author had given them no idea as to the size of the throat or what proportion of air was put into the air cell and what proportion was left over the piston in the combustion chamber proper. Mr. Paxman refuted the idea expressed by the author of the paper that engines with the Aero type of head were more difficult to start, owing to high heat losses. Further, to obtain brake m.e.p.'s of 132 lb. per sq. in., as Mr. Sanders claimed for his engine, it would be necessary to burn more oxygen than there was available in the cylinder unless the fuel consumption was less than 0·4 lb. per b.h.p. hr. In the Paxman-Ricardo engine the brake m.e.p. had stopped at 116-117 lb. per sq. in., and supercharging was necessary in order to obtain pressures of 128-132 lb. per sq. in. With a Ricardo head it was possible with the Paxman engine to get down to a consumption of 0·38 lb. per b.h.p. hr. over a range of 70 to 100 lb. per sq. in. and a piston speed of 1,800 ft. per min. with a cylinder bore of 6 or 7 in.

GERMAN LOCAL TRAFFIC RAILCAR.—The Moselbahn, a private railway whose track follows closely the sinuous course of the river Mosel for upwards of 60 miles, has just put into service a double-bogie diesel railcar powered by two Deutz engines of 125 b.h.p. each. The engines are mounted on a welded steel subframe below the car, and drive the inner axle of each bogie through four-speed Mylius gearboxes, giving road speeds of 7½, 14¾, 26, and 41 m.p.h. The car, which was built by the Waggonfabrik Wismar, seats 84 passengers on a tare weight of 24 tonnes.

SAAR RAILCARS.—We are informed that since the transference of the Saar Railways to the Reichsbahn, the smaller of the two types of railcars whose working costs were given in our issue of September 4, have been withdrawn, as it was considered that the power, two 55 b.h.p. engines, was insufficient for the duties which could be given them and bigger engines could not be fitted on account of the construction of the car. This applies also to the Ford petrol cars. The larger vehicles, powered by two 90 b.h.p. Deutz oil engines, are still in service.

NOTES AND NEWS

American Enquiry.—The Birmingham Southern Railway in the U.S.A. is proposing to purchase 10 double-bogie diesel-electric shunting locomotives.

Olive Oil for Lubrication.—Investigations are being made in France to determine the practicability of the use of a mixture of olive and mineral oils for the lubrication of small high-speed engines.

Japanese Diesels.—Low and moderate-powered bogie railcars are being used to an increasing extent on the various 3 ft. 6 in. gauge private railways in Japan. Some are used for the haulage of trailers and others, with a semi-streamlined contour, are operated alone.

P.L.M. Diesel Mileage.—The mileage covered by railcars on the P.L.M. Railway has risen from 1,000 km. (620 miles) in the first half of 1932 to 2,046,000 km. (1,270,000 miles) in the second half of 1935, and to 3,275,000 km. (2,040,000 miles) in the first half of 1936.

More Locomotives for France.—The P.L.M. Railway has ordered three oil-electric shunting locomotives from the Forges et Acieries de la Marine et d'Homecourt. They will be of the double-bogie type and will be powered by supercharged Sulzer engines with an output of 570 b.h.p. The estimated weight is 71 tons.

Another Argentine Extension.—As we recorded in THE RAILWAY GAZETTE for September 4, the Buenos Ayres Great Southern Railway has ordered seven light bogie railcars from the Drewry Car Co. Ltd. They are to be powered by 6 L.W. Gardner engines of 100 b.h.p., and will have Vulcan Sinclair fluid couplings and Wilson-Drewry epicyclic four-speed gearboxes. They are to seat 40 passengers and will have mail and baggage accommodation.

Government Locomotives.—The 160 b.h.p. Gleniffer-engined diesel shunting locomotive built by Andrew Barclay & Sons Ltd. for the Air Ministry has been delivered. The motive power equipment was described in the issue of this Supplement for July 10. The War Office has placed an order with the Hunslet Engine Co. Ltd. for a diesel-mechanical shunting locomotive to be powered by a Gardner 8L3 engine of 204 b.h.p.—the largest size of Gardner engine yet used in traction work.

Indo-China Extension.—Following the introduction of the six 280 b.h.p. Decauville railcars on the Yunnan Railway, described in the issue of this Supplement for July 10, the State Railways of Indo-China have ordered six metre-gauge 250 b.h.p. Renault diesel-mechanical cars, the design of which is to be based on the standard Renault vehicle in France. The cars will seat 12 European second-class and 34 fourth-class native passengers within a length of 62 ft. 6 in. They are to be used on accelerated short-distance services out of Hanoi and Saigon, and between Saigon and Mytho.

New Zephyrs.—About the end of this month, the two new 12-car Zephyr trains will go into service between Chicago and Denver. The aggregate power is to be 3,000 b.h.p., made up of one 1,200 b.h.p. engine in one power car and two 900 b.h.p. engines in the power car at the other end. Towards the end of the year the two four-car 660 b.h.p. Twin Zephyrs operating between Chicago and the Twin Cities, will be transferred to other routes and replaced by two 1,800 b.h.p. seven-car trains of the same Budd stainless-steel construction. These trains will seat 194 passengers, plus 32 in the dining car.

Diesels in West Africa.—Two diesel-mechanical railcars, each powered by a 125 b.h.p. Berliet oil engine and fitted with Minerva mechanical transmission, are being built in France for fast light services for Europeans over the 267-mile metre-gauge line between Cotonou and Parakou, in Dahomey, which has long grades of 1 in 66-70. The cars will be of the double-bogie type and will carry 9 first class and 8 second class passengers. A buffet is to be incorporated.

Dutch Trains.—Hitherto the 40 diesel-electric trains of the Netherlands Railways have been arranged to work no more than two in multiple-unit, but they are now being modified to permit of three or more rakes being coupled together and operated by one driver, so that steam trains of any formation may be replaced as desired. Small kitchens are to be fitted into some of the trains, so that when the mid-country lines are electrified the diesel sets can be used to provide a buffet service on the longer routes to Groningen and Maastricht from Amsterdam and Rotterdam.

American Streamlined Train Costs.—The two 660 b.h.p. trains named *The Rebel*, of the Gulf, Mobile & Northern Railway which were described in the issue of this Supplement for August 9, 1935, have been operating at an average cost of 33 cents (16·3d.) per train-mile, this total not including financial charges or the wages of the dining car staff. Repairs to motive power have been 3·5 cents (1·73d.) and to the mechanical portion 6·0 cents (2·96d.) per train mile. Fuel costs were only 2 cents (0·99d.) per mile, but the railway lies in a district where oil is cheap; the consumption averages 0·495 American gal. per train-mile, or something like 3·7 lb. per mile.

Railcar School.—The P.L.M. Railway has established at Dijon-Ville station a school for training employees as drivers, guards and shed fitters for diesel railcars. Drivers and guards are selected from the personnel of the traction and traffic departments (firemen, fitters, &c.), and occasionally from other departments, and candidates must undergo first a psychological-physiological examination. After an elimination course of a full week, those left pass through a second course of two full weeks at the school, and then by a further two weeks on railcars along with the regular drivers and guards. Practical instruction also is given directly on four old railcars on the line from Dijon to Epinac-les-Mines. Another course is given for shed fitters and shop workmen, but both courses include a certain amount of theoretical study of the diesel engine and transmission. A total of 260 employees has passed through the school.

INTERNATIONAL DIESEL SERVICE

On February 1, 1937, through diesel services are to begin between Paris and Belgium with some of the new French Nord triple-car trains built by the Soc. Franco-Belge, and described in the issue of this Supplement for September 4. On the Paris-Brussels route these trains will cover the 193 miles in 3 hr. inclusive of stops at St. Quentin, Aulnoye, and Mons. On the Liege route stops will be made at St. Quentin, Aulnoye, Jeumont, Charleroi and Namur.